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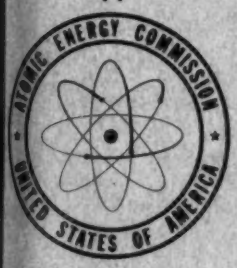

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NUCLEAR SCIENCE ABSTRACTS

Volume 10 August 31, 1956 No. 16

GENERAL

ATOMIC BOMBS AND WARFARE

5439 NP-5873
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
A SIMPLE METHOD FOR EVALUATING BLAST EFFECTS ON BUILDINGS. (Revised Edition). July 1954. 48p.

A method is presented for estimating the approximate effect of an atomic blast on one-story steel and concrete buildings which have specified length-width-height ratios and which are closed, almost completely closed, or open. The object of the method is to calculate the order of magnitude of the maximum displacement of the top of the building. This displacement is not calculated directly. Rather a measure of the displacement is obtained by analyzing the behavior of a mass-spring model which is, elastically, similar to the building and which is subjected to a similar force. The motion of this model is assumed to be indicative of the motion of the building under the actual blast. A detailed procedure for computing the approximate deflection of the building is included and is supplemented by a numerical example. An estimate of the accuracy of the method is furnished. (auth)

5440 USNRDL-TR-74
Naval Radiological Defense Lab., San Francisco.
RADIOLOGICAL DEFENSE MEASURES AS A COUNTERMEASURE SYSTEM. W. E. Strope. Feb. 15, 1956. 38p. Project NS 083 001.

The importance of considering radiological defense measures as an interrelated system rather than as a collection of individual measures is emphasized. In discussing the radiological defense system, the defense problem is divided into three time phases: emergency, operational recovery and final recovery. The objectives and measures of effectiveness in each phase are discussed. Countermeasures are classified as to type. The concept of a central countermeasure type in each phase is introduced. Central countermeasures are selected and their interactions are discussed. It is concluded that failure to recognize the interactions between countermeasures is resulting in development of countermeasures on incompatible grounds. (auth)

ATOMIC POWER

5441
COMMERCIAL AND INTERNATIONAL DEVELOPMENTS IN ATOMIC ENERGY. PROCEEDINGS OF A MEETING FOR MEMBERS AND GUESTS HELD SEPTEMBER 27–29, 1955 AT SHERATON-PARK HOTEL, WASHINGTON, D. C. A FORUM REPORT—NO. 7. Edwin Wiggin, ed. New York, Atomic Industrial Forum, Inc., 1956. $8.50.

The texts of 67 papers on commercial and international developments in atomic energy given at a meeting in Washington, D. C. in September, 1955, are given. General categories considered are reactors, reactor safety, radiation and radioisotopes, business opportunities, government activities, international activities, and the Geneva conference. A pictoral supplement on the first U. S. trade fair on atomic energy is appended. (D.E.B.)

Refer also to abstracts 5477, 5794, and 5896.

BIOLOGY AND MEDICINE

5442 AF-SAM-55-25
Texas. Univ., Austin. Radiobiological Lab.
A SHOCK-AVOIDANCE APPARATUS EMPLOYING AN INSTRUMENTAL MANIPULATORY RESPONSE. William H. Melching. Aug. 1955. 8p.

A shock-avoidance apparatus employing an instrumental manipulatory response for the behavior testing of monkeys is described. Suggestions and recommendations are made with respect to the design and function of this type of apparatus. (auth)

5443 AWRE-O-61/54
Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
A CONTRIBUTION TO THE TECHNIQUE OF LEUCOCYTE COUNTING. K. C. Parry. Nov. 30, 1954. 7p.

5444 UCRL-3407
California. Univ., Berkeley. Radiation Lab.
THE INFLUENCE OF DIETARY FACTORS UPON HUMAN SERUM LIPOPROTEIN CONCENTRATIONS. Alex V. Nichols, Virginia Dobbin, and John W. Gofman. May 8, 1956. 21p. Contract W-7405-eng-48. $0.25(OTS).

5445
METABOLISM OF COBALT-60 IN CHICKENS. Cheng-Chun Lee and L. F. Wolterink (Michigan State Coll. and Michigan Agricultural Experiment Station, East Lansing). Poultry Sci. 34, 764-76(1955) July.

Cobalt 60, as $Co^{60}SO_4$, is both readily absorbed from the intestinal tract and returned to the intestinal tract through its wall in the chicken. Twenty-four hours after Co^{60} is administered intravenously or injected into the gizzard of the chicken 6% of the injected dose may be recovered from the small intestine, 5% from both caeca, 1% from the large intestine and 5% from the extracellular fluid. During this period, if the Co^{60} is injected intravenously, at least 13% of the injected dose is eliminated in the feces and a large fraction of the remaining 70% is excreted in the urine emptied into the cloaca. If the Co^{60} is injected into the gizzard, at least 51% appears in the feces and a fraction of the remaining 32% appears in the urine by the end of 24 hours. Most of the Co^{60} found in the caecum enters from the gut. However, under certain experimental conditions (such as complete obstruction both of the large intestine and of the caecum itself) Co^{60} passes into the caecum through the wall in large amounts. Co^{60} is greatly concentrated in the caecal contents, in the caecal wall, and in the small and large intestines regardless of the route of administration. In these locations, it is present in some non-diffusible form or forms. A very small amount of Co^{60} is found in the bladder bile. (auth)

AEROSOLS

5446 USNRDL-TR-78
Naval Radiological Defense Lab., San Francisco.
AN APPARATUS FOR EXPOSING MICE TO RADIO-

ACTIVE AEROSOLS. J. C. Sherwin, R. K. Fuller, W. B. Lane, and L. L. Wiltshire. Feb. 2, 1956. 21p. Project NM-006-015.

RADIATION EFFECTS

5447 AF-SAM-55-41

School of Aviation Medicine, Randolph AFB, Texas.
BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION. CLINICAL AND HISTOLOGICAL OBSERVATIONS OF RADIATION DAMAGE OCCURRING IN THE MAMMALIAN EYE. Paul A. Cibis, Werner K. Noell, and Bertram Eichel. Apr. 1955. 20p.

The effect of massive doses of x radiation upon the eye was studied in experiments on 9 albinotic and 6 pigmented guinea pigs, 60 New Zealand and 60 chinchilla grey rabbits, 2 rhesus monkeys, and 2 dogs. The clinical and histological changes in the retina were observed. The most significant post-radiation effect was the immediate and irreversible impairment of the rod cells manifested by typical changes in the ERG, night blindness, constriction of the visual field, and pyknosis of the rod nuclei followed by degeneration of the outer retinal layers. (auth)

5448 NP-5877

Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 18. Jan. 15, 1956. 140p. Contract AF41(657)-25.

Progress is reported in studies on the effects of ionizing radiations on the 5-nucleotidase activity of mammalian hematopoietic tissues; an investigation of the influence of substituted pyrimidines, phenothiazines, carbamates, cytotoxins and metabolic antagonists on the survival time and mortality of irradiated mice and rats; the influence of metabolic antagonists, cytotoxins, and cortical hormones on the adenosine triphosphatase activity of the hematopoietic tissues of irradiated mice; and the influence of high temperature and other environmental factors on the susceptibility of animals to the injurious actions of ionizing radiations. (For preceding period see NP-5815.) (C.H.)

5449 UR-435

Rochester, N. Y. Univ. Atomic Energy Project.
A METHOD FOR THE SAFE FIRING OF MAGNESIUM POWDER TO PRODUCE LARGE AREA FLASH BURNS. R. E. Roth, H. W. Bales, and H. E. Pearse. Apr. 20, 1956. 15p. Contract W-7401-eng-49. $3.30(ph OTS); $2.40 (mf OTS).

5450

EFFECT OF TOTAL-BODY X-IRRADIATION ON FAT BALANCE AND LIVER LIPIDS IN THE RHESUS MONKEY. John G. Coniglio, W. J. Darby, J. Ann Efner, Jim Fleming, and Granville W. Hudson (Vanderbilt Univ. School of Medicine, Nashville, Tenn.). Am. J. Physiol. 184, 113-18(1956) Jan.

Fat balance studies were done on rhesus monkeys irradiated with 325, 400 and 650 r total-body x irradiation. The postirradiational results were compared with the preirradiational values of the same monkeys and with those obtained in pair-fed controls. No defect in fat absorption was found due to the irradiation. Increased fecal fat loss after irradiation was observed in both irradiated and nonirradiated animals. Monkeys given 650 r had liver lipid concentrations similar to their pair-fed controls. These analyses were done at 12, 96, and 229 days after irradiation. Changes in body weight in all animals paralleled decreases in food intake immediately after irradiation and subsequent increases with recovery. Hematologic studies showed the usual decrease in leucocyte count after irradiation. One monkey given 650 r was killed 12 days postirradiation because death was imminent; all other animals survived the irradiation. (auth)

5451

INFLUENCE OF X-IRRADIATION UPON WATER CONSUMPTION BY THE RAT. Douglas E. Smith and Ella B. Tyree (Argonne National Lab., Lemont, Ill.). Am. J. Physiol. 184, 127-33(1956) Jan.

Water consumption was measured daily after single, total-body exposures of intact and adrenalectomized rats to x-radiation, and single, partial-body irradiations of intact rats. The intakes of 20% sucrose and of 1% NaCl were measured in hypophysectomized and adrenalectomized, irradiated rats, respectively. Beginning on the first day after exposure there occurred increases and decreases in water consumption which were related to x-ray dosage and to the portion of the body irradiated. The variation in response was very high between individuals. Adrenalectomy abolished the polydipsia which immediately follows irradiation. The possible influence of the pituitary-adrenal system upon the irradiation-induced changes in water consumption is discussed. (auth)

5452

INITIAL RADIATION SYNDROME IN THE ADULT CHICKEN. S. Phyllis Stearner, Margaret Sanderson, Emily J. Christian, and Austin M. Brues (Argonne National Lab., Lemont, Ill.). Am. J. Physiol. 184, 134-40(1956) Jan.

In the adult rooster the dose-rate dependent early mortality that followed x irradiation was similar to that reported for young chicks. Although a small drop in blood pressure occurred within 30 to 60 minutes after exposure, a critical hypotension was not seen during the initial postirradiation period. Both 24-hr survivors and nonsurvivors showed an increase in urate excretion during the first 10 to 12 hours after irradiation. Apparently, the slight fall in blood pressure that occurred after x ray exposure was not sufficient to affect renal function directly. In addition, the epithelium of the adult kidney is not as radiosensitive as that of the young chick; histopathologic changes are minimal. Although no serious hypotension was observed during the initial postirradiation period in the adult, there was qualitative clinical evidence of a circulatory insufficiency with pooling of blood in peripheral organs. In irradiated chicks a similar condition is accompanied by severe hypotension. However, results of experiments on hemorrhagic shock indicate that the adult can compensate for much greater loss of circulating volume without a decrease in blood pressure than can the young chick. (auth)

5453

CELLULAR RADIOBIOLOGY. Robert K. Mortimer and Carl A. Beam (Univ. of California, Berkeley). Ann. Rev. Nuclear Sci. 5, 327-68(1955).

Literature published primarily during 1953 and 1954 on various aspects of cellular radiobiology is reviewed. 401 references. (C.H.)

5454

STIMULATION OF ERYTHROPOIESIS IN SUBLETHALLY IRRADIATED RATS BY A PLASMA FACTOR. Frederick Stohlman, Jr. and George Brecher (National Inst. of Health, Bethesda, Md.). Proc. Soc. Exptl. Biol. Med. 91, 1-4(1956) Jan.

Injection of plasma from anemic donors into rats immediately following exposure to sublethal doses of x rays produced a statistically significant increase in erythropoiesis as measured by Fe^{59} incorporation. The factor present in anemic plasma was nondialyzable and was not present in the supernatant obtained after precipitation of protein by heating. Normal plasma produced a variable response. Use of sublethally irradiated rat as a test animal in the study of regulation of erythropoiesis is suggested. (auth)

5455

WATER INTAKE OF GUINEA PIGS AS PARAMETER IN ORAL DRUG THERAPY OF EXPERIMENTAL IRRADIATION.

Friedrich Ellinger (National Naval Medical Center, Bethesda, Md.). Proc. Soc. Expti. Biol. Med. 91, 172-4(1956) Jan.

Drinking habits of guinea pigs kept on a diet of dry food and drinking water have been studied to ascertain the amount of daily water consumption which may serve as a parameter for oral drug administration. There is a difference between water intake of non-irradiated and irradiated animals. This difference is chiefly accounted for by reduced water intake of animals succumbing to irradiation, which stopped drinking prior to death. Water consumption of irradiated animals is not materially altered during the critical first 8 days after irradiation, irrespective of death rate produced later on. Use of oral administration of water-soluble drugs with drinking water appears therefore possible with a sufficient degree of accuracy. (auth)

5456

THE INACTIVATION OF ATTACHMENT AND MUTUAL EXCLUSION PROPERTIES IN BACTERIAL VIRUSES BY IONIZING RADIATION. Ernest Pollard and Jane Setlow (Yale Univ., New Haven, Conn.). Radiation Research 4, 87-101(1956) Feb.

5457

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF FAST NEUTRONS, X-RAYS, AND γ-RAYS FOR ACUTE LETHALITY IN MICE. A. C. Upton, F. P. Conte, G. S. Hurst, and W. A. Mills (Oak Ridge National Lab., Tenn.). Radiation Research 4, 117-31(1956) Feb.

Young adult female mice were exposed to single doses of Co^{60} γ-rays, 250-kvp x rays, or cyclotron fast neutrons. The $LD_{50}/30$ days was 730 rep for γ-rays, 528 rep for x-rays, and 362 rep for fast neutrons. If the RBE of γ rays is assumed to be 1.0, then the RBE of x rays is 1.4 and that of fast neutrons 2.0 for $LD_{50}/30$ days. (auth)

5458

STUDIES ON BONE MARROW LIPID IN NORMAL AND IRRADIATED RABBITS. Frederick Bernheim, Athos Ottolenghi, and Karl M. Wilbur (Duke Univ., Durham, N. C.). Radiation Research 4, 132-8(1956) Feb.

Rabbit bone marrow homogenates, unlike those of liver, kidney, and brain, do not produce fatty acid peroxides when incubated in vitro. Marrow extracts inhibit peroxide formation in liver homogenates. Marrow extracts protect the succinoxidase against inhibition by fatty acid peroxides. This effect is apparently dependent on the sulfhydryl content of the extract. Forty-eight hours after exposure of the rabbit to 1400 r, marrow homogenates produce peroxides when incubated in vitro. They also have measurable amounts of peroxides in the fat fraction before incubation. Extracts from rabbits exposed to 800 r are less effective than normal ones in protecting the succinoxidase against peroxides. There was a significant increase in linoleic, linolenic, and total fat in the marrow of the irradiated animals. Vitamins K, A, and E inhibit peroxide formation in liver homogenates but do not protect succinoxidase against inhibition by peroxides. (auth)

5459

ACTION OF X-RAYS ON DIDINIUM NASUTUM. D. C. Shepard, A. C. Giese, and C. L. Brandt (Stanford Univ., Calif.). Radiation Research 4, 154-7(1956) Feb.

Direct irradiation of Didinium nasutum delays division, the delay being greater the larger the dosage. A diet of paramecia irradiated just short of a cytolytic dosage does not affect division of didinia. The only possible positive effect was the death of a small fraction of the population. Brief exposure of didinia to irradiated medium delays division; longer exposure kills them. The possible implications of the results are discussed. (auth)

5460

PRELIMINARY REPORT OF X-RAY STUDIES ON THE GOLDEN NEMATODE. G. Fassuliotis and A. H. Sparrow (Brookhaven National Lab., Upton, N. Y.). Plant Disease Reptr. 39, 572(1955) July 15.

Data are presented which indicate that the life cycle of the golden nematode is interrupted by exposure to doses of X radiation of 20,000 r or above. Radiation treatment of potatoes not only increases storage life of the potatoes, but prevents the spread of the golden nematode on infected potatoes. (C.H.)

5461

MORPHOLOGICAL CHANGES IN THE MEDULA OBLANGATA NERVE CELLS OF WHITE MICE DURING GENERAL ROENTGEN IRRADIATION. M. I. Sorokina. (Severtsev Inst. of Animal Morphology). Doklady Akad. Nauk S.S.S.R. 106, 51-3(1956) Jan. 1. (In Russian).

Investigations of morphological changes, occurring in the nervous system under irradiation, were made by observing the process from the initial moment of the animal exposure to the moment of its death. Studies were made with adult white normal mice, and mice exposed to irradiation of various lethal doses of roentgen radiation (700r, 1000r, and 5000r). Various results of the observed morphological changes show the dependence of these changes not only on the radiation dose but also on the individual characteristics of the animals. The data indicate that the morphological criteria revealed a high sensitivity of the nerve tissue to radiation. This was substantiated by the appearance of destructive changes in the early stages of exposure. (R.V.J.)

5462

ON THE RATE OF TRACER INCLUSION INTO THE ALBUMIN OF IRRADIATED ANIMALS. S. N. Aleksandrov. Doklady Akad. Nauk S.S.S.R. 106, 153-6(1956) Jan. 1. (In Russian).

A systematic study was made to observe the rate of albumin restoration in various organs of irradiated animals at different stages of radiation sickness. Methylamine labeled with S^{35} was used as tracer and the rate of albumin restoration was judged by the speed of absorption of the labeled acid. (R.V.J.)

5463

ON THE RATE OF TRACER INCLUSION INTO THE ALBUMIN OF IRRADIATED ANIMALS. S. N. Aleksandrov. Doklady Akad. Nauk S.S.S.R. 106, 363-6(1956). Jan. 11. (In Russian).

Data on the rate of tracer inclusion into the albumin of various organs of irradiated animals, in cases of acute radiation sickness was presented in the previous article. Studies are made of the rate of tracer inclusion into the albumin of animals in sub-acute forms of sickness. The experiments were made with the mice of both sexes, weighing 18 to 20g. The methylamine labeled with S^{35} in 500r doses was used as a tracer; the mice were killed 1.5 hours after the injection. The observations showed that in sub-acute forms of radiation sickness, the accelerated process of albumin restoration did not stop at the initial critical period and did not break off sharply as it did in the cases of acute forms of the sickness. (R.V.J.)

5464

THE UPTAKE OF PHOSPHORUS 32 BY THE KNEE JOINT AND TIBIA OF SIX-WEEK-OLD MICE AND THE EFFECT OF X RAYS UPON IT. VARIATION OF UPTAKE WITH TIME AFTER A DOSE OF 2000r OF kV X RAYS. C. W. Wilson (Westminster Hospital, London). Brit. J. Radiol. 29, 86-91(1956) Feb.

Experiments are described which examine the effect of a single x-ray dose of 2000 r to the knee joint and tibia of six-week-old mice upon the uptake of P^{32} in these bones at varying intervals after irradiation up to 22 weeks. It is shown that in the knee joint, after a latent period of about

one week the uptake of P^{32} falls progressively to reach a minimal value of about 55% after about four weeks. The relationship of these results to those obtained by others for the depression of alkaline phosphatase activity is discussed. It is suggested that the time sequence of the irradiation effects involved may be suppression of osteoblastic activity leading to immediate and increasing depression of alkaline phosphatase activity as a result of which, after the latent period, new calcification is depressed in increasing amount until the maximum is reached. The depression is maintained until about eight to ten weeks after irradiation following which a slow recovery seems to occur, but this is still incomplete at the end of 22 weeks. In the tibia similar effects of a similar magnitude were observed but they develop more slowly. This difference may be related to differences between the growth activity of the knee joint and tibia. (auth)

5465

INDUCTION OF MUTATIONS IN MICE BY CHRONIC GAMMA IRRADIATION: INTERIM REPORT. T. C. Carter, Mary F. Lyon, and Rita J. S. Phillips (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Radiol. 29, 106-8(1956) Feb.

Estimation of the genetic hazard of ionizing radiations to man calls for ecological and genetic study of human populations and experimental work on other mammals. An interim report is given of a long-term experiment intended to check the linearity of the mutation-rate/radiation-dose law at seven specified loci in the mouse, using low accumulated γ-ray doses. (auth)

5466

MODIFICATION OF LETHAL RADIATION EFFECTS IN RATS BY SHORT-TERM PROTRACTION OF DOSAGE. Jack S. Krohmer, John P. Storaasli, and Hymer L. Friedell (Western Reserve Univ., Cleveland). Radiology 66, 270(1956) Feb.

Results are reported from studies of radiation effects in rats from which it was concluded that, within certain limits, dose fractionation is not important, provided the total time of irradiation and the total dose are kept constant and that no individual fraction is so great as to produce significant lethal radiation effects by itself. (C.H.)

5467

THE EFFECTS OF THERMAL NEUTRON RADIATION ON MUTATION OF ENDOSPERM LOCI IN MAIZE. Calvin F. Konzak and W. Ralph Singleton (Brookhaven National Lab., Upton, N. Y.). Proc. Natl. Acad. Sci. U. S. 42, 78-84(1956) Feb.

5468

THE EFFECT OF INCUBATION TIME ON MACROCOLONY FORMATION AFTER X-IRRADIATION OF MICROORGANISMS. Shirley E. Gunter and Henry I. Kohn (Univ. of California School of Medicine, San Francisco). J. Bacteriol. 71, 124-5(1956) Jan.

5469

HUMAN CHORIORETINAL BURNS FROM ATOMIC FIREBALLS. H. W. Rose, David V. L. Brown, Victor A. Byrnes, and Paul A. Cibis (U.S.A.F. School of Aviation Medicine, Randolph Field, Tex.). Arch. Ophthalmol. 55, 205-10(1956) Feb.

The history, ophthalmoscopic findings, and visual impairment in six human cases of chorioretinal burns due to atomic flash are described. The physical, anatomical, and physiological factors contributing to the production of the lesions are discussed. (auth)

5470

THE ELIMINATION OF RADIOACTIVE BARIUM SULFATE PARTICLES FROM THE LUNG. H. Cember, T. F. Hatch, J. A. Watson, T. Grucci, and P. Bell (Univ. of Pittsburgh). Arch. Ind. Health 13, 170-6(1956) Feb.

The radiation effect on the pulmonary clearance mechanisms was studied by exposing one group of rats to radioactive barium sulfate particles of high specific activity and another group to particles of very low specific activity. No difference between the elimination rates of these two classes of particles was observed. The effective half life of the particles in the deep respiratory tract was found to be two days. Although there was a suggestion that the particles may undergo solution in the lungs, the chief route of elimination was mechanical removal up the bronchial tree, followed by swallowing and subsequent elimination via the urine and feces. (auth)

5471

GENETICAL EFFECTS OF RADIATIONS FROM PRODUCTS OF NUCLEAR EXPLOSIONS. F. W. Spiers (Univ. of Leeds, England). (Included is a reply to this paper by J. B. S. Haldane, Univ. Coll., London). Nature 177, 226-7(1956) Feb. 4.

Relative radiation dose-rates to man and to Drosophila are discussed. Data previously presented by Prof. J. B. S. Haldane on the genetical effects of radiation resulting from nuclear explosions are reviewed. A reply from Prof. Haldane presents revised calculations of radiation dose rates. (C.H.)

RADIATION HAZARDS AND PROTECTION

5472 AECU-3258

Division of Biology and Medicine. Civil Defense Liaison Branch, AEC.

PLUTONIUM HAZARDS CREATED BY ACCIDENTAL OR EXPERIMENTAL DETONATION OF ATOMIC WEAPONS. R. L. Corsbie. Based on work done by W. H. Langham, P. S. Harris, and T. L. Shipman, Los Alamos Scientific Lab. May 1956. 5p. $1.80(ph OTS); $1.80(mf OTS).

Hazards from Pu resulting from atomic explosions are discussed. Protective measures and decontamination procedures are outlined. (C.H.)

5473 AERE-SPAR-1

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MONTE BELLO RAT, NOVEMBER 1953. PAPER 1. D. W. H. Barnes, G. E. Harrison, J. F. Loutit, W. H. A. Raymond. With appendices by G. J. Neary. July 1955. 22p.

Rats inhabiting Monte Bello at the time of the atomic explosion were examined for both external signs of radiation damage and damage from the ingestion of contaminated food. Results are tabulated from radiochemical analysis of tissue samples and activity of soil samples from the area. Data are included on the estimated radiation dose rate to the rats from the contaminated soil. (C.H.)

5474 AERE-SPAR-3

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECTS OF OPERATION HURRICANE ON PLANTS AND SOILS. PAPER NO. 3. R. Scott Russell, H. M. Squire, and R. P. Martin. July 1955. 106p.

Fall-out samples collected in air filters by aircraft and on gage sheets 24 hrs following the Monte Bello burst were analyzed. Samples of plant material collected shortly afterwards were also analyzed. Fourteen months later the site was inspected and plant and soil samples were collected for radiometric and radiographic analysis. Data are tabulated on the biological availability of fall-out, the movement of fall-out in soil, the mode of contamination of vegetation, the relative absorption of different fission products by plants, and the relative magnitude of different hazards resulting from the deposition of fission products in herbage. (C.H.)

5475 AWRE-O-43/54

Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.

SLIDE RULE FOR COMPUTATION OF AIR SAMPLING RESULTS. P. A. Carter. Aug. 1954. 9p.

A slide rule is described for calculating the concentration and health hazard involved from data obtained in air sample tests. The time involved in computing each result is approximately 40 seconds. (auth)

5476 NM-006.012.04.91

Naval Medical Research Inst., Bethesda, Md. and Naval Radiological Defense Lab., San Francisco.

EMERGENCY LABORATORY ORGANIZATION FOR THE CARE OF LARGE NUMBERS OF HUMAN BEINGS ACCIDENTALLY EXPOSED TO IONIZING RADIATION. C. R. Sipe, P. K. Schork, C. P. A. Strome, and William H. Gibbs. Nov. 18, 1955. 13p.

The accidental exposure of a group of Marshallese and Americans to radioactive fallout in the spring of 1954 necessitated organizing and equipping an emergency medical team for the purpose of conducting essential laboratory and clinical examinations on the exposed individuals. The materiel, facilities, and personnel required for emergency laboratory analyses in an operation of this kind is discussed. Details of laboratory requirements and procedures used in examining a large number of individuals under circumstances necessitating a maximum of information with a minimum of equipment and trained personnel are presented. Basic organization for routine clinical observation is also included. (auth)

5477

LEGISLATIVE CONTROL OF RADIATION. Lauriston S. Taylor (National Bureau of Standards, Washington, D. C.) Radiology 66, 246-52(1956) Feb.

Two states now have radiation-control regulations and several others are in the process of developing them. With the increasing use of radiation in industry, medicine, and research, a great many more people are now affected, and the situation has become of concern to labor and public health authorities, and to the public at large. Recommendations of the National Committee on Radiation Protection on the regulation of radiation exposure by legislative means are reviewed. (C.H.)

5478

CHEMICAL PROTECTION AGAINST IONIZING RADIATIONS. Z. M. Bacq (Univ. of Liège, Belgium). Research 9, 62-6 (1956) Feb.

The protection of living organisms and certain non-living organisms is of prime importance. Experiments have shown that certain radio-protectors are equally effective in reducing radio-damage in both groups. The protector competes with radio-sensitive molecules or groups for the free radicals formed from the products of water hydrolysis and their reaction with oxygen during radiation. (auth)

5479

MODIFICATION OF RADIATION INJURY IN THE RABBIT. L. O. Jacobson, E. K. Marks, and E. O. Gaston (Univ. of Chicago). Proc. Soc. Exptl. Biol. Med. 91, 135-9(1956) Jan.

Postirradiation injection of mouse embryo cells or baby mouse liver or spleen cells enhances significantly the survival of rabbits exposed previously to 900 r total-body x radiation without producing an appreciable effect upon hematologic recovery as observed in the peripheral blood. (auth)

5480

A NOMOGRAPHIC WHEEL FOR THREE DIMENSIONAL LOCALIZATION OF RADIUM SOURCES AND CALCULATION OF DOSE RATE. J. Garrett Holt (Memorial Center for Cancer and Allied Diseases, New York). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 476-83(1956) Mar.

A wheel nomograph has been designed to simplify the problem of calculating gamma-ray dose rates from any number of internal radium sources to a given point. The wheel can be adapted for use with other isotopes by marking the appropriate corrections on the r/mg.-hr scale. In practice the wheel has been a great time saver, it has reduced the time of dose rate calculations from four to six hours to about twenty minutes and it has lent itself to many applications. (auth)

5481

A GRAPHICAL METHOD FOR THE LOCALIZATION OF RADIUM SOURCES FOR DOSAGE CALCULATION. Morton M. Kligerman, Howard W. Vreeland, and Jan Havinga (Columbia Univ. and Presbyterian Hospital, New York). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 484-94 (1956) Mar.

A complete clinical procedure for determination of radium dosage using a graphic method is presented, which includes roentgenography, selection of critical points, and graphic localization in step by step working form. (auth)

5482

A NEW RADIUM IMPLANT TECHNIQUE TO REDUCE OPERATING ROOM EXPOSURE AND INCREASE ACCURACY OF PLACEMENT. Robert Fishman and Lester I. Citrin (V. A. Hospital, Bronx, N. Y.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 495-6(1956) Mar.

A new method is presented for decreasing the exposure of personnel during radium implantation and achieving increased accuracy. Dummy needles in plastic sheaths are inserted, followed by rapid replacement of the dummy needles by radium. (auth)

5483

THE EFFECT OF ACTH AND CORTISONE ON RADIATION PNEUMONITIS. Florence C. H. Chu, James J. Nickson, and Ali R. Uzel. Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 530-41(1956) Mar.

A study of the effects of ACTH and cortisone on radiation pneumonitis in 15 cases is presented. A brief review of the reports in the literature is given. No definite evidence of protection against development of pneumonitis by the use of ACTH or cortisone was seen in 8 cases. No appreciable evidence of improvement in roentgenographic signs of radiation pneumonitis was found in 12 cases of this series. ACTH and cortisone alleviated symptoms caused by radiation pneumonitis in some of the cases. In evaluation of effects of any therapeutic agent on radiation pneumonitis, the importance of considering the variability of the natural course of radiation pneumonitis is stressed. (auth)

RADIATION SICKNESS

5484 NM-006-012.05.15

Naval Medical Research Inst., Bethesda.

PHARMACOLOGICAL STUDIES ON IRRADIATED ANIMALS. IV. WATER INTAKE OF GUINEA PIGS AS A PARAMETER OF ORAL DRUG ADMINISTRATION IN EXPERIMENTAL RADIATION THERAPY. Friedrich Ellinger. Nov. 8, 1955. 8p.

In the study of the effects of drugs on x-ray-induced mortality of experimental animals, the use of the oral route is preferable in many instances to the administration by injection because of the increased bleeding tendency exhibited by some of the laboratory animals. From this point of view the present study has been undertaken. The drinking habits of guinea pigs were studied in order to ascertain the amount of daily water consumption which would serve as a parameter for oral drug administration. It has been shown that there is a difference between the water intake of non-irradiated and irradiated animals. This difference is

chiefly accounted for by a reduced water intake of the animals, succumbing to the irradiation; these animals stopped drinking prior to death. It was noted that the water intake during the critical period for drug administration, the time prior to irradiation death, was not significantly changed irrespective of the mortality later on produced by various x-ray doses. The use of the oral administration of water-soluble drugs with drinking water appeared therefore possible with a sufficient degree of accuracy. (auth)

Refer also to abstract 5483.

RADIOTHERAPY

5485

THE PALLIATIVE THERAPY OF PERITONITES AND PLEURITES IN ASCITES CARCINOMA WITH RADIOACTIVE GOLD. R. C. W. Visser and P. J. L. Scholte. J. belge radiol. 38, No. 4, 680-90(1955). (In Dutch).

5486

NEUTRON-RADIOACTIVATED PURE CHROMIUM CRYSTALS AS SOURCES OF GAMMA RAYS FOR RADIATION CHEMOTHERAPY. William G. Myers (Ohio State Univ. Health Center, Columbus). Radiology 66, 268(1956) Feb.

The preparation and use of Cr^{51} crystals as γ sources for use in radiotherapy are discussed briefly. (C.H.)

5487

AN INSTRUMENT FOR CALCULATING RADIUM DOSES. L. E. Mussell (Radium Inst., Liverpool, England). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 497-9(1956) Mar.

An instrument is developed for calculation of radium doses given in the radium treatment of carcinoma of the cervix uteri or in any other application where the dose rates are required at a small number of specified positions, and the radium sources are a sufficiently short distance from specified positions, so they can be taken as point sources. The instrument permits routine calculations to be made simply and rapidly. (R.V.J.)

5488

THE THERAPEUTIC USE OF SINGLE DOSES OF TOTAL BODY RADIATION. Vincent P. Collins and R. Kenneth Loeffler (Baylor Univ. Coll. of Medicine and Jefferson Davis Hospital, Houston, Tex.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 542-7(1956) Mar.

Total body irradiation in a single exposure up to 200 roentgens of 250-kv roentgen rays may be safely administered to patients with generalized cancer. Considered as one form of systemic therapy rather than an alternative or competitive method of treatment, total body irradiation in doses of this order is a useful addition to the management of advanced cancer. (auth)

5489

ROTATION THERAPY WITH A COBALT 60 UNIT. I. PHYSICAL ASPECTS OF CIRCUMAXIAL ROTATION. Paul M. Pfalzner and W. R. Inch. Acta Radiol. 45, 51-61 (1956) Jan.

Dose distributions as measured in circumaxial rotation with a Co^{60} teletherapy unit and their variation with axial field size and phantom diameter are presented. A comparison of 360° and 270° rotational isodose distributions is shown. A brief outline is given of the method used to determine rotational treatment factors, and a simple setting-up procedure, using only a front and back pointer and two skin marks, is described. Radiographic positioning checks can be performed satisfactorily for most sites with Co^{60} radiation. A versatile rotation stretcher-chair combination is described. The treatment is technically convenient and rapid. (auth)

5490

TESTING FOR SIGNIFICANT DIFFERENCES BETWEEN RESULTS OF VARYING TREATMENT TECHNIQUES. Margaret Owchar (Manitoba Cancer Relief and Research Inst., Winnipeg, Canada) and A. J. Phillips (National Cancer Inst. of Canada, Toronto). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 607-8(1956) Mar.

The advent of Co^{60} beam therapy and the availability of supervoltage therapy units in cancer treatment lead to a consideration of the problem of assessing various forms of treatment. The purpose of the paper is the analysis of the sensitivity of Student's t-test in testing for significant difference between the results of two methods of treatment. (R.V.J.)

5491

NEUTRON CAPTURE THERAPY: SLOW NEUTRON DEPTH DISTRIBUTION MEASUREMENTS IN TISSUE. E. E. Stickley (Brookhaven National Lab., Upton, N. Y.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 609-18(1956) Mar.

The general pattern of slow neutron penetration has been determined by the use of foil activation techniques in phantoms having neutron-sensitive characteristics equivalent to tissue. The patterns are applicable in a strict sense only to the experimental facility where they were made. They are, at present, the best data available for calculation of the heavy particle radiation dose in the neutron capture therapy experiment. (auth)

5492

SOME APPLICATIONS OF RADIOACTIVE ISOTOPES IN OPHTHALMOLOGY. M. Lederman (Royal Marsden Hospital, London and Westminster and Central Eye Hospital, London). Brit. J. Radiol. 29, 1-13(1956) Jan.

Recent applications of radioactive P and Sr as β sources and radioactive Ta and Co as γ sources for the radiotherapy of eye lesions are reviewed. Ulceration, vascularization, malignant melanoma, cancerous melanoma, and retinoblastoma were benefited by treatments employing radioisotopes. Results of treatments are tabulated and illustrated photographically. (C.H.)

5493

TANTALUM 182 WIRE GAMMA-RAY APPLICATORS FOR USE IN OPHTHALMOLOGY. N. G. Trott and B. M. Wheatley (Royal Cancer Hospital, London). Brit. J. Radiol. 29, 13-14 (1956) Jan.

An account is given of two methods of using Ta^{182} wire in γ-ray applicators, for the treatment of certain diseases of the eye. Dose distributions for the applicators can be readily computed and measured. Data, including isodose curves, for a typical applicator are presented. (auth)

5494

THE CONSTRUCTION AND MEASUREMENT OF BETA-RAY APPLICATORS FOR USE IN OPHTHALMOLOGY. W. K. Sinclair and N. G. Trott (Royal Cancer Hospital, London). Brit. J. Radiol. 29, 15-23(1956) Jan.

β-ray emitting ophthalmic applicators, using Sr^{90} foil, have been developed following earlier work with P^{32}. Details are given of these Sr^{90} applicators, which have the form of spherical caps. A number of physical investigations of these applicators are described. Dose-rate variations across the surface were studied using a scintillation probe; the same instrument was used to find the variation of dose-rate with depth in tissue equivalent material, and to compare the dose-rate from the applicators with that from a plane sheet of foil. The method used to determine in absolute units the surface dose-rate from this plane foil, and hence from the applicators, is also described. Surface dose-rates for applicators at present in use are of the order of 100 rad/min. (auth)

5495

AN EVALUATION OF THE USE OF RADIOIODINE IN THE DIAGNOSIS OF HYPERTHYROIDISM. G. R. Fryers (Univ. of Leeds and United Leeds Hospitals, England). Brit. J. Radiol. 29, 24-31(1956) Jan.

The conclusion that study of the initial thyroid uptake and for urinary excretion both provide efficient tests for use in the diagnosis of thyrotoxicosis seems warranted. The other criteria studies are less effective and this investigation does not justify their continued use. The accuracy of measurement of urinary excretion is limited only by the patient's ability to follow instructions. On the other hand the measurement of thyroid uptake does not suffer from this limitation and it is expected that detailed alterations in the technique used here will result in increased accuracy. A useful margin of superiority should then be shown by tests employing thyroid uptake compared with tests depending on renal excretion only. (auth)

5496

LEUKAEMIA FOLLOWING RADIOIODINE TREATMENT OF HYPERTHYROIDISM. E. E. Pochin, N. B. Myant, and B. D. Corbett (Univ. Coll. Hospital Medical School, London). Brit. J. Radiol. 29, 31-5(1956) Jan.

A patient died of acute leukemia 28 months after her hyperthyroidism had been effectively treated with 7.1 mc of radioiodine. This dose is unlikely to have caused radiation of more than 100 reps in relevant extrathyroid tissues. (auth)

5497

A QUANTITATIVE AUTHORADIOGRAPHIC STUDY OF RADIOIODINE DISTRIBUTION AND DOSAGE IN HUMAN THYROID GLANDS. W. K. Sinclair, John D. Abbatt, Helen E. A. Farran, Eileen B. Harriss, and L. F. Lamerton (Royal Cancer Hospital; Hammersmith Hospital; and New End Hospital, London). Brit. J. Radiol. 29, 36-41(1956) Jan.

Using autoradiographic techniques, a study has been made of the non-uniformity of radioactivity distribution and radiation dosage in human thyroid glands following administration of I^{131} to the patient. The ratio of the maximum to the mean radiation dose in the gland has been measured for a number of different cases and the significance of the findings is briefly discussed. (auth)

5498

IMPROVED EQUIPMENT FOR INTRA-CAVITY ADMINISTRATION OF RADIOACTIVE COLLOIDAL GOLD. D. G. Arnott (London Hospital). Brit. J. Radiol. 29, 62(1956) Jan.

Refer also to abstracts 5854 and 5857.

TOXICOLOGY STUDIES

5499 CWLR-2031

Chemical Warfare Labs., Army Chemical Center, Md.

THE MEDIAN LETHAL CONCENTRATION OF DIBORANE VAPOR FOR RATS AND MICE. Lorraine H. Lawson and Keith H. Jacobson. Mar. 3, 1956. 13p. Project 4-61-14-002.

Median lethal concentrations for 4-hr exposures of rodents to diborane were determined to facilitate comparison of the acute toxicities of various boron compounds. These LC-50 values were 80 ppm for 5-mo-old Chemical Warfare Laboratories Colony rats, 40 ppm for 2-mo-old Edgewood Breeding Farms rats, and 29 ppm for Carworth Farms mice. Evidence from an additional experiment with the two strains of rats suggests that the difference in LC-50 values for the rats results in greater measure from the age or weight difference than from the strain difference. Flies were also exposed to diborane, and results from these exposures show that flies are not useful as diborane detectors. (auth)

5500 WADC-TR-55-16

National Research Council. Div. of Biology and Agriculture.

HANDBOOK OF TOXICOLOGY. VOLUME I. William S. Spector, ed. Apr. 1955. 415p. Contract AF33(616)-2973. (AD-75869).

This report presents, in tabular form, data on acute toxicities of more than 2,000 substances for several species of commonly used laboratory animals. The values have been culled from the literature over a period of years, and wherever possible have recently been rechecked with original publications. To enhance reliability, and consequently usefulness, of the tables, the data have been exhaustively reviewed by twenty-eight experts in the field. The tables in this unusually complete collection of toxicity values are unique in their treatment of the well-known phenomenon of toxicological variability. In addition to indicating a single value on the toxicity of each substance for a given animal, the table presents information concerning the lethal dosage range, vehicle, route of administration, and time of death, whenever such information was available in the references. The literature source cited for each line of data is presented on that line to facilitate rapid location of additional material for which space was not available in the book. Supplementing the quantitative data are an easily comprehensible and directly useable cross index of chemical compounds, including synonyms; a complete list of abbreviations with full titles of references cited in the volume; and a compilation of all symbols, with definitions therefor, used in the text. A lucid introduction explains some of the problems encountered in compiling toxicity values and the reasons for such wide variations in those values even within a single species. The introduction emphasizes that this book is intended to be used as a yardstick rather than as a collection of explicit and definitive values. (auth)

5501

STUDIES WITH RADIOPHOSPHORUS IN DROSOPHILA. VI. THE EFFECT OF DNP ON PHOSPHORUS INCORPORATION BY ADULT DROSOPHILA MELANOGASTER. Louise P. Wilson and R. C. King (Wellesley Coll., Mass. and Brookhaven National Lab., Upton, N. Y.). J. Exptl. Zool. 130, 341-52(1955) Nov.

A study was made of the effect of dinitrophenol upon viability, growth, and phosphorous incorporation by adult Drosophila melanogaster. Results are tabulated and presented graphically. Data are included on normal P metabolism in Drosophila. (C.H.)

5502

RADIUM INHALATION ACCIDENT—RADIUM EXCRETION STUDY. W. B. Looney and V. E. Archer (U. S. Naval Hospital and National Inst. of Arthritis and Metabolic Diseases, Bethesda, Md.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 548-58(1956) Mar.

A report is made of 2 cases of accidential radium inhalation. The excretion of radium by one was followed for over a year. Radon breath samples were considered to give a poor index of exposure in these cases. The efficacy of different methods of determining the body radium content is reviewed. The amount of radium inhaled was estimated from excretion data. It was found that 76% of the inhaled radium was excreted in the first five days. The feces contained 97% of the eliminated radium. These excretion data were added to data from the literature to illustrate the exponential decrease of the coefficient of excretion. Suggestions for therapy are made. (auth)

TRACER APPLICATIONS

5503 UR-450
Rochester, N. Y. Univ. Atomic Energy Project.
KIDNEY LOCALIZING PROTEINS DERIVED FROM NORMAL TISSUES. William F. Bale, Irving L. Spar, and Ruth L. Goodland. May 9, 1956. 20p. Contract W-7401-eng-49. $3.30(ph OTS); $2.40(mf OTS).

5504
USE OF MEMBRANE FILTERS IN THE MEASUREMENT OF BIOLOGICAL INCORPORATION OF RADIOACTIVE ISOTOPES. Daniel E. Atkinson and Bruce A. McFadden (Univ. of California, Los Angeles). J. Bacteriol. 71, 123-4(1956) Jan.

A method is described for use in estimations of total isotope incorporation into metabolizing cells. A membrane filter is employed for collection of the samples for counting. The method is reported to save time, eliminate essentially all sources of manipulative error, and allow any degree of washing with no loss of cells. (C.H.)

5505
ABSORBABILITY OF BETA-SITOSTEROL. R. Gordon Gould (Los Alamos Scientific Lab., N. Mex.). Trans. N. Y. Acad. Sci. (2) 18, 129-34(1955) Dec.

Pure β-sitosterol was labeled with tritium by exchange with high specific activity tritium water. Data are presented on the tissue distribution following oral administration to rats and humans. No effect was observed of absorbed β-sitosterol on plasma cholesterol levels. (C.H.)

5506
STRONTIUM^{85} METABOLISM IN MAN AND EFFECT OF CALCIUM ON STRONTIUM EXCRETION. Herta Spencer, Milton Brothers, Eva Berger, H. E. Hart, and Daniel Laszlo (Montefiore Hospital, New York). Proc. Soc. Exptl. Biol. Med. 91, 155-7(1956) Jan.

Radiostrontium metabolism following intravenous administration of tracer doses of Sr^{85} was studied in 4 human subjects. Plasma levels, and urinary and fecal Sr excretion were measured. The plasma levels declined rapidly. The main route of excretion is via the kidney. Rate of Sr excretion seems to depend upon the state of bone metabolism. It was low in Paget's disease and high in senile osteoporosis. Simultaneous administration Ca gluconate significantly enhanced the Sr excretion. (auth)

Refer also to abstracts 5487 and 5491.

CHEMISTRY

5507 IGR-TN/C-276
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
THE REACTION OF LITHIUM WITH NITROGEN. P. B. Longton. Dec. 12, 1955. 11p.

The reaction between N and Li at constant pressure over the range 50 to 750 mm Hg and at temperatures from 300 to 450°C has been investigated. Reaction was found to occur smoothly and to conform to a parabolic rate law after an initial short period. The activation energy for the reaction was determined from the temperature coefficient of the parabolic rate constant, and has a value of 16,980 ± 900 cal/mole, independent of temperature and pressure over the ranges studied. (auth)

5508 MAB-104-M
National Research Council. Materials Advisory Board.
CONFERENCE ON HIGH TEMPERATURE ELASTOMERS, OCTOBER 28-29, 1955. 13p.

The chemical and physical properties of elastomers which may be suitable for high-temperature applications were discussed. Recommendations for future research projects are included. (C.W.H.)

5509 MCC-1023-TR-186
Johns Hopkins Univ., Baltimore.
ISOTOPIC STUDIES ON SOME GASEOUS BORANES. Final Report. W. S. Koski, R. P. Hamlen, J. J. Kaufman, T. E. Larson, P. C. Maybury, and J. E. Todd. June 30, 1955. 90p. [For Olin Mathieson Chemical Corp. Contract NOa (s)-52-1023-c].

The exchange reaction between diborane (B_2H_6) and pentaborane-9 (B_5H_9) was found to 0.5 order with respect to B_2H_6 and first order with respect to B_5H_9. The exchange reactions between diborane and dihydropentaborane, tetraborane, and decaborane were also studied. Methods have been developed for boron isotopic analysis and total boron analysis of boron hydrides by neutron absorption. (C.W.H.)

5510 MCC-1023-TR-187
Syracuse Univ., N. Y.
COMPLEXES OF ETHERS WITH DIBORANE. Final Report. Henry A. Wirth and Franklin Massoth. Nov. 1955. 56p. For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c.

Phase diagrams of the systems diborane–diethyl ether, diborane–methyl ethyl ether, diborane–dimethyl ether, diborane–tetrahydrofuran, diborane–tetrahydropyran, diborane–perfluoroether, and diborane–cyclo-C_4F_8O were studied. Normal borine complexes of the type ether : BH_3 were found for dimethyl ether, diethyl ether, tetrahydrofuran, and tetrahydropyran. The relative stabilities were $Me_2O:BH_3$, $C_4H_8O:BH_3$, $C_5H_{10}O:BH_3 \gg Et_2O:BH_3$. Diethyl ether also formed a second, weaker complex, having the empirical formula, $Et_2O \cdot 1\ ½B_2H_6$. It is suggested that this may be a combination of a borine complex and a boron to carbon coordination complex. Methyl ethyl ether formed a weak complex corresponding to $MeEtO \cdot B_2H_6$. This is explained on the assumption of boron to carbon bonding. Diborane formed no complex with perfluoroether or cyclo-C_4F_8O. The reaction between diborane and dimethyl ether in the gas phase was found to obey the equilibrium: $Me_2O + 2B_2H_6 \rightleftharpoons Me_2O \cdot 2B_2H_6$. The equilibrium constant at 1.1°C was calculated to be $4.4 \times 10^{-2} \pm 1.0\ atm^{-2}$. Values for the thermodynamic constants ΔH, ΔF, and ΔS at 1.1°C were computed to be −3.1 kcal/mole, 1.7 kcal/mole and −17 e.u., respectively. Boron to carbon bonding was advanced to expain the high diborane to ether ratio. (auth)

5511 MCC-1023-TR-191
Saint Louis Univ.
THE REACTION OF COPPER(I) CHLORIDE WITH LITHIUM BOROHYDRIDE IN DIETHYL ETHER (thesis). Richard H. Toeniskoetter. Feb. 1956. 58p. For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c.

The reaction of lithium borohydride with copper(I) chloride in diethyl ether has been investigated by two methods: a study of the factors affecting the rate of production of B_2H_6 from the system and the demonstration of the stoichiometry of the reaction at room temperature. Of the factors affecting the rate of production of B_2H_6, temperature, and the concentration of Et_2O appear to be the most important. The overall reaction at room temperature is adequately represented by the following equation: $LiBH_4 \cdot Et_2O + CuCl = LiCl + ½B_2H_6 + ½H_2 + Cu + Et_2O$. (auth)

5512 WADC-TR-55-26(Pt.III)
Rutgers Univ., New Brunswick, N. J. School of Chemistry.
RESEARCH ON BORON POLYMERS. [Period covered] December 1954 to December 1955. William L. Ruigh, Frank C. Gunderloy, Jr., Michael Sedlak, and P. A.

van der Meulen. Dec. 1955. 48p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-2057.

A new, simple, and efficient synthesis of boron substituted borazoles has been developed. Butylboron dichloride reacts with ammonia to give a high yield of B-tributylborazole. This synthesis will be broadened by the employment of substituted amines. Some of the resulting B-N substituted borazoles may serve as the basis of thermally and hydrolytically stable semi-inorganic polymers and the liquid borazoles will be evaluated as lubricants and hydraulic fluids. For preceding period see WADC-TR-55-26(Pt.II). See also NP-5767. (auth)

5513 WADC-TR-56-82

University of Southern California, Los Angeles.
PRINCIPLES OF INORGANIC POLYMERIZATION. Part I of Final Technical Report [for] February 1955 to January 1956. Anton B. Burg, Peter J. Slota, Jr., Walter Mahler, and Gordon L. Juvinall. Jan. 1956. 52p. Project No. 7340. Contract AF33(616)-2743.

Phosphinoborine trimers, $(R_2PBH_2)_3$, have been prepared by three methods. Polymers of varying stability are obtained from a reaction between Me_2PH and Me_2NBH_2; the P atom supports the polymerization of Me_2NBH_2. The high-polymer from heating of $Me_2NPMe_2{\cdot}2BH_3$ is a brittle glassy white solid, stable and almost inert to air at 300°C. Similarly, a high polymer made from B_5H_9 and Me_2NPMe_2, and having a considerable excess of B atoms over P + N atoms, can be heated in oxygen to 450°C. without serious damage. An improved method of making $(CF_3)_3P$, $(CF_3)_2PI$, and CF_3PI_2 involves generation of CF_3I from iodine and $AgCO_2CF_3$ in the presence of phosphorus, in a steel pressure bomb. Successful chemical methods of analysis include alkaline hydrolysis for CF_3-P links and fluoride by spectrophotometry. A CF_3 group on B should be unstable unless the fourth valence orbital of B is occupied; hence $(Me_2N)_2BCl$ has been made and used in attempts to form a $B-CF_3$ compound wherein pi-bonding to B would afford stabilization. $AgCO_2CF_3$ and $(Cl_2PN)_3$ begin to react at 135°C, forming chiefly AgCl and $(CF_3CO)_2O$ in such proportions as to indicate conversion of the $(Cl_2PN)_3$ to a new polymer, $[(ClPN)_2O]_x$, wherein $(PN)_n$ rings or chains would be connected by P-O-P linkages. (auth)

5514 WIS-ONR-18

Wisconsin. Univ., Madison. Naval Research Lab.
HEAT TRANSFER IN CHEMICALLY REACTING GAS MIXTURES. Joseph O. Hirschfelder. Feb. 6, 1956. 28p. Contract N7-onr-28511.

If a chemically reacting gas mixture is confined between two parallel plates, one hot and the other cold, the temperature and the chemical composition at a point as well as the overall heat flux depend upon the rates of both the homogeneous reactions in the gas phase and the heterogeneous reactions on the surfaces. Detailed examples are given for a unimolecular rearrangement $A \rightleftharpoons B$ and for the dissociation of oxygen, $0_2 \rightleftharpoons 20$. The assumption of local chemical equilibrium is found to be very good and to greatly simplify the problem if the reactions are fast in either the forward or the reverse direction. The effective coefficient of heat conductivity has the same form as the Eucken coefficient of heat conductivity for polyatomic molecules, only here we have generalized the effective thermal conductivity to include chemical reactions as well as internal degrees of freedom. It is found that the usual Eucken relation definitely is not valid for hot gases where many of the molecules are in excited electronic states. Under ordinary conditions it is suggested that the Eucken relation be slightly modified so that the correction for the internal degrees of freedom for the molecule should be (2/5) $[(C_v/R) + 1]$. (auth)

5515 AERE-Lib/Trans-698

THE PREPARATION OF ANHYDROUS TITANIUM(II)-CHLORIDE. V. Gutman, H. Nowotny, and G. Ofner. Translated by F. Hudswell from Z. anorg. u. allgem. Chem. 278, 78-81(1955). 4p.

The preparation of anhydrous $TiCl_2$ by the reduction of $TiCl_4$ with H in the electrodeless electrical discharge, is described. The $TiCl_2$ obtained is free from Ti metal. (auth)

5516 AERE-Lib/Trans-700

CATHODIC LIMITING CURRENTS IN FUSED SALTS. P. Drossbach and P. Petrick. Translated by F. Hudswell from Z. Elektrochem. 58, 95-9(1954). 12p.

The cathodic limiting currents were determined experimentally in the electrolysis of $PbCl_2$, $CdCl_2$, $NiCl_2$, CuCl and AgCl in fused mixtures with KCl + LiCl. The experiments were made in crucibles of porcelain, nickel, platinum or sintered alumina. A graphite rod served as the anode. A tungsten rod, ground down to about 0.5 mm diameter at its lower end, was used as the cathode. The effective surface area of the anode amounted to about 1.6 cm^2, that of the cathode 0.04 cm^2. The temperature of experiment amounted in all cases to 450°C. (auth)

5517

NOTE ON THE THEORY OF DIFFUSION CONTROLLED REACTIONS: APPLICATION TO PHOTODISSOCIATION IN SOLUTION. Louis Monchick (Univ. of Notre Dame, Ind.). J. Chem. Phys. 24, 381-5(1956) Feb.

The theory of diffusion controlled reactions has been reconsidered in the light of modern transport theory, and it has been concluded that the use of the Smoluchowski equation is valid for most problems of usual interest. The probability of reaction has been calculated for two molecules initially separated by a distance r', in the presence of a third reactant present in uniform concentration. The resulting formulas have been used to discuss the quantum yields of photodissociation of Br_2, Br_3^-, and I_3^- in aqueous solution. The dependence on temperature and wavelength can be qualitatively accounted for. (auth)

5518

STUDY OF ALCOHOL AND KETONE REACTIONS WITH PENTABORANE. A. F. Zhigach, E. B. Kazakova, and R. A. Kigel. Doklady Akad. Nauk S.S.S.R. 106, 69-71(1956) Jan. 1. (In Russian).

The reactions of methyl, ethyl, and butyl alcohols and acetone with pentaborane were analyzed. (R.V.J.)

5519

KINETICS OF THE THERMAL AND PHOTOCHEMICAL EXCHANGE BETWEEN BENZYL IODIDE AND IODINE. Moshe Gazith and Richard M. Noyes (Columbia Univ., New York). J. Am. Chem. Soc. 77, 6091-8(1955) Dec. 5.

The exchange between benzyl iodide and I_2 has been studied both thermally and photochemically in hexachlorobutadiene-1,3. The reaction proceeds by a radical chain mechanism initiated by dissociation of both species and involving alternately benzyl radicals and iodine atoms. A direct substitution by iodine atoms may also occur. All seven of the rate constants for the individual steps have been estimated at 36°C. The data help to establish the benzyl-iodine bond strength. Oxygen inhibits the reaction by reacting reversibly with benzyl radicals, but it does not appear to affect iodine atoms. These results support previous proposals that the molecular and atomic exchange reactions of allyl iodide involve direct interaction with the double bond and also suggest that allylperoxy radicals may react with other radicals by substitution reactions leading to stable products. (auth)

Refer also to abstract 5478.

AEROSOLS

5520

AEROSOLOSCOPE COUNTS PARTICLES IN GAS. E. S. Gordon (Armour Research Foundation, Chicago), D. C. Maxwell, Jr. (Crosley Division of Avco Manufacturing Co., Evendale, Ohio), and N. E. Alexander (Chemical Corps Biological Labs., Camp Detrick, Md.). Electronics 29, No. 3, 188-92(1956) Mar.

The aerosoloscope in one operation automatically detects particles from 1 to 64 microns in diameter and classifies them into 12 adjacent size groups within this range. It counts and classifies at a maximum rate of 100 particles per second and accepts aerosols of concentrations up to 10,000 particles per cc. (auth)

ANALYTICAL PROCEDURES

5521 AERE-C/R-1813

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE VOLUMETRIC DETERMINATION OF URANIUN IN ALUMINIUM–URANIUM ALLOYS. A. Bacon and G. W. C. Milner. Mar. 21, 1956. 21p.

The determination of macro amounts of uranium by reduction to the tetravalent state with a lead reductor followed by titration with a standard ceric sulfate solution was studied and the precision of the method at the 100-mg level of uranium determined. This procedure has proved applicable to the determination of the uranium content of aluminium–uranium alloys containing 20% uranium. Results obtained for the analysis of synthetic alloy solutions and for typical alloy castings are reported and discussed. Experiences with the accurate standardization of ceric sulfate solutions against recognized primary standards are described. (auth)

5522 AERE-SPAR-4

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

STRONTIUM AND BARIUM IN PLANTS AND SOILS. PAPER 4. H. J. M. Bowen and J. A. Dymond. July 1955. 17p.

A method is described for the determination of Sr and Ba in plants and soil extracts using the technique of activation analysis. (C.H.)

5523 IGO-AM/S-10

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF THORIUM IN PLANT INTERMEDIATE PRODUCTS AFTER A SULPHURIC ACID LEACH OF MONAZITE ROCK. Dec. 30, 1955. 12p.

Thorium is separated from any sulfate and chloride ions by precipitation as the hydroxide. The solution is centrifuged, supernatant liquor is decanted off, and the precipitate dissolved with nitric acid. The thorium is extracted from other impurities into a solution of 40% TBP/xylene, and then back extracted into water, and estimated by titration with a solution of ethylenediamine tetraacetic acid. The method is suitable for solutions containing between 30 and 500 mg thorium and up to 350 mg of rare earth phosphates in the aliquot taken. (auth)

5524 IGO-AM/S-16

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF COMBINED NITROGEN IN URANIUM METAL, URANIUM POWDER AND URANIUM DIOXIDE. Jan. 10, 1956. 9p.

The nitrogen is converted to ammonia which is then steam-distilled and determined absorptiometrically using Nessler's reagent. The method as written is suitable for the determination of nitrogen between 5 and 150 ppm. (auth)

5525 PA-TR-2206

Pictinny Arsenal. Samuel Feltman Ammunition Labs., Dover, N. J.

SPECTROGRAPHIC METHOD FOR ANALYZING ZIRCONIUM HYDRIDE, ZIRCONIUM METAL, AND ZIRCONIUM–NICKEL ALLOYS. Sol Weisberger. July 1955. 26p. Ord Project WD OAC 7001420-19-99105. (AD-69133).

Research was conducted to develop spectrographic methods for the simultaneous quantitative determination of (1) Fe, Al, Ti, Mg, Si (as SiO_2), Ca, and Hf in ZrH_4 and Zr metal, both in the powdered state; and (2) the foregoing impurity elements, with the exception of Hf, and with the addition of Cr, in powdered alloys of 70/30 and 30/70 Zr/Ni. One gram of the finely divided sample is converted to the oxide, mixed with 2 parts of pure-briquetting graphite, and briquetted into $\frac{1}{4}$-in.-diam pellets. A spectrogram is obtained by arcing for 25 sec with a graphite counter electrode utilizing an arc of 2400 v and 2.0 amp. The percentage of the relative transmittances of elements and Zr lines are measured from the spectrogram. From the calculated intensity ratios, the amounts of the elements present are obtained from the working curves previously prepared with synthetic standard samples. The method can be expected to give results accurate to within 10% of the actual content of the above-listed elements. The developed method has a useful range from 0.05 to 1.0% for the determination of Fe, Al, Ti, Mg, Si, and Ca in ZrH_4, Zr metal, and Zr–Ni alloys and for Cr in Zr–Ni alloys. For the Hf contents in Zr and ZrH_4, the range extends from about 0.5 to 10.0%. (ASTIA abst.)

5526 TEI-555

Geological Survey.

THE DETERMINATION OF URANIUM IN ORES: SEPARATION BY ETHYL ACETATE EXTRACTION AND SPECTROPHOTOMETRIC DETERMINATION BY THE THIOCYANATE METHOD IN ACETONE–WATER MEDIUM. H. I. Feinstein. Sept. 1955. 16p.

The thiocyanate method is applied to the determination of U in ores after separation by ethyl acetate extraction. Reasonable control of acidity and thiocyanate concentration eliminates the erratic results that are sometimes obtained by thiocyanate methods. The use of the extraction procedure permits the determination of U in vanadium-bearing ores, minerals, and rocks. An accuracy of ±2% of the accepted value can be readily achieved. (auth)

5527 AEC-tr-2499

QUANTITATIVE ORGANIC MICROANALYSIS (A STUDY OF MICROMETHODS OF ORGANIC ANALYSIS BY HYDROGENATION). A. Lacourt and Ch. T. Chang. Translated by K. Bevis from Bull. soc. chim. Belg. 49, 167-80(1940). 7p.

The analytical methods employing hydrogenation are considered, and are based on the cracking of the organic material by using high temperatures and a hydrogen atmosphere, the element to be determined appearing in its reduced state or in the form of a hydrogenated compound. Decomposition of the sample and determination of the element are accomplished in one and the same operation. They are thus distinguished from the principal methods of organic analysis formerly practiced and, from analytical processes using oxidation, such as, combustion in air, in oxygen, decomposition by nitric, chromic, or sulfuric acid, etc. (auth)

5528 AERE-Lib/Trans-604

SYSTEMATIC INVESTIGATIONS ON THE APPLICATION OF DIETHYLDITHIOCARBAMATE IN ANALYSIS. Helmut

Bode. Translated by A. H. Gillieson from Z. anal. Chem. 144, 165-86(1955). 23p.

The application of diethyldithiocarbamate in analysis by the formation of the metal- diethyldithiocarbamates and their ease of extraction in relation to the pH value of the solution was investigated. (auth)

5529 RAE-Trans-543

QUANTITATIVE SPECTROCHEMICAL ANALYSIS WITH THE CONSTANT TEMPERATURE D.C. ARC. (Quantitative Spektrochemische Analyse Mittels des Gleichstrom Kohlebogens). N. W. H. Addink. Translated by B. E. C. Jenkins from Spectrochem. Acta 7, 45-59(1955). 15p. (AD-77339).

The constant-temperature d-c arc technique, developed at Eindhoven, is described and discussed, and a number of empirically determined K values are given. In this method, 5 mg of powdered samples are introduced into a cavity in the anode, together with graphite powder, a flux, and suitable materials to modify the rate of volatilization. A complete combustion is obtained by a 7 to 12 amp d-c arc. Line intensities are calibrated by comparison with selected iron lines. Some examples of the calculation are given, and the reliability of the method is assessed. (auth)

5530 TIB/T4433

THE CHROMATOGRAPHIC SEMI-MICROANALYSIS OF GASES. X. THE DETERMINATION OF SMALL TO MINUTE QUANTITIES OF HELIUM PLUS NEON, AND OF HYDROGEN, IN GASES. (Chromatografická Semimikroanalysa Plynu. Stanovení Malých Až Stopových Množství Helia S. Neonem A. Vodíku V Plynech.). J. Janak and K. Tesarik. Translated from Chem. Listy, 48, 1051-7(1954). 11p. (AD-66935).

The chromatographic determination of microquantities of He, Ne, and H_2 in gas mixtures, based on a gas absorption and condensation method is described. (C.W.H.)

5531

TRICHLOROPHENOXYACETIC ACID AS A REAGENT FOR THE DETERMINATION OF THORIUM. Sachindra K. Datta (Darjeeling Government Coll., India). Anal. Chim. Acta 14, 39-44(1956) Jan.

Trichlorophenoxyacetic acid quantitatively precipitates thorium, thus separating Th from the alkaline earth and rare earth metals. Zirconium and Fe^{3+} interfere. (C.W.H.)

5532

THE DIRECT WEIGHING OF ZIRCONIUM TETRAMANDELATE. Richard B. Hahn and Eugene S. Baginski (Wayne Univ., Detroit). Anal. Chim. Acta 14, 45-7(1956) Jan.

The non-stoichiometry of zirconium tetramandelate precipitates is explained by the presence of basic salts of varying composition. For reproducible results the zirconium tetramandelate should be precipitated from hot, strongly acid solution by the dropwise addition of mandelic acid. (auth)

5533

A PROCEDURE FOR THE DETERMINATION OF RADIOACTIVITY DUE TO FISSION PRODUCT NIOBIUM. D. F. C. Morris and D. Scargill (Atomic Energy Research Establishment, Harwell, Berks, England). Anal. Chim. Acta 14, 57-61(1956) Jan.

A procedure using TBP solvent extraction has been devised and investigated for the determination of the activity in irradiated U due to fission product Nb. The method gives good radiochemical purity and a standard deviation of 2% or less, except on material which has had a very short cooling time since the end of neutron irradiation. (auth)

5534

THE COLORIMETRIC DETERMINATION OF THORIUM USING 1-(O-ARSONOPHENYLAZO)-2-NAPHTHOL-3:6-DISULPHONIC ACID. J. Clinch (Thorium Limited, Ilford, Essex, England). Anal. Chim. Acta 14, 162-71(1956) Feb.

A method is described for the determination of Th in milligram quantities using 1-(o-arsonophenylazo)-2-naphthol-3, 6-disulphonic acid (thoron) with a precision of 0.5%. An account of the interferences to be expected from some common ions is given and the method is employed in the determination of Th in monazite following an oxalate separation. (auth)

5535

ANALYSIS OF SAMPLES CONTAINING URANIUM, NIOBIUM, AND ZIRCONIUM. Philip J. Elving and Edward C. Olson (Univ. of Michigan, Ann Arbor). Anal. Chem. 28, 338-42 (1956) Mar.

The importance to the atomic energy program of reasonably rapid, simple, and accurate methods for the analysis of mixtures containing uranium, niobium, and zirconium prompted an investigation of polarographic and amperometric procedures for this purpose. Mixtures containing U and Zr can be analyzed by polarographing an aliquot of a 10% sulfuric acid solution between 0.0 and −0.5 volt to determine U and titrating another aliquot amperometrically with standard cupferron solution at −1.0 volt to determine Zr. In mixtures containing U, Nb, and Zr, the Zr is separated as the phosphate from hydrogen peroxide-sulfuric acid solution, and the suspended phosphate is titrated amperometrically with cupferron. The U and Nb are determined simultaneously from the polarogram of their solution in concentrated hydrochloric acid. Errors are about 1% for U and Nb, and about 0.5% for Zr. The procedure was successfully applied to the assay of a Nb ore. (auth)

5536

RADIOMETRIC DETERMINATION OF INORGANIC FLUORIDE. E. I. Onstott and W. P. Ellis (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 393-7(1956) Mar.

A radiometric-volumetric procedure for the determination of fluorides is described which uses Sm^{3+} as the precipitant and Eu^{3+} carrier-tracer to detect the end point. Under optimum conditions, 20 to 30 mg of fluoride can be determined with an error of less than 1%. (C.W.H.)

5537

PHOTOMETRIC DETERMINATION OF BORON IN TITANIUM AND ITS ALLOYS. R. C. Calkins and V. A. Stenger (Dow Chemical Co., Midland, Mich.). Anal. Chem. 28, 399-402 (1956) Mar.

A method was desired which would incorporate the precision of a photometric method into the determination of small amounts of B in Ti. Application of the carminic acid method for B requires complete elimination of the Ti. Conditions have been found under which this may be done by cation exchange removal of the peroxy-titanium(IV) complex. Boron is determined on the residue from a neutralized and evaporated aliquot of the column effluent. Vanadium is the only interfering element that has been encountered. This interference is negligible if the alloy contains less than 0.3% V with 0.005 to 0.10% B, or if not more than 10 times as much V as B is present in the higher ranges. (auth)

5538

ULTRAVIOLET SPECTROPHOTOMETRIC DETERMINATION OF ZIRCONIUM. Richard B. Hahn and Leon Weber (Wayne Univ., Detroit). Anal. Chem. 28, 414-15(1956) Mar.

Zirconium tetramandelate dissolves in aqueous NH_3, forming a soluble, saltlike compound that exhibits maximum absorbance at a wave length of 258 mμ. This is used as the

basis of a spectrophotometric method for the determination of milligram amounts of Zr in the presence of Al, Fe, and Ti. (auth)

5539

OSCILLOMETRIC DETERMINATION OF FLUORIDE. Clarence L. Grant and Helmut M. Haendler (Univ. of New Hampshire, Durham). Anal. Chem. 28, 415-18(1956) Mar.

A procedure is described for the determination of macro quantities of fluoride, and employs a modification of the Willard and Winter steam-distillation procedure, followed by accurate adjustment of the pH, and subsequent titration with thorium nitrate using a high frequency oscillometer for end point detection. For the range of 3 to 8 mg of fluoride per 100 ml of solution, the average accuracy is within 0.2%. The method is rapid and has the particular advantage of being easily adaptable to automatic recording. (auth)

5540

DETERMINATION OF NICKEL, CHROMIUM AND MOLYBDENUM USING THE SPEKKER ABSORPTIOMETER. J. Winning and S. Miller (Albion Motors, Ltd., Glasgow, Scotland). Metallurgia 53, No. 315, 50-2(1956) Jan.

The reagents used in the improved methods described are all everyday inexpensive chemicals, and a considerable increase in speed and a substantial saving in cost compared with those using perchloric acid or silver nitrate is claimed. Moreover, the absence of heavy fumes improves the laboratory atmosphere appreciably. (auth)

5541

SPECTROPHOTOMETRIC ESTIMATION OF THORIUM BY MORELLIN. B. R. Lakshman Rao and C. C. Patel (Indian Inst. of Science, Bangalore). Proc. Indian Acad. Sci. 42A, 317-25(1955) Dec.

The spectrophotometric determination of Th has been studied by employing morellin which forms an orange-red complex in alcoholic solution. The complex obeys Beer's law at 515 mμ in the range 1.4 to 25 ppm of thorium and is stable between pH 5 and 7. Limits of tolerance of interfering ions were also estimated. (auth)

5542

AN ABSORPTIOMETRIC METHOD FOR THE DETERMINATION OF BERYLLIUM IN BERYL. J. B. Pollock (Geological Survey of Uganda, Entebbe). Analyst 81, 45-8(1956) Jan.

A method is described in which beryl is decomposed by fusion with NaF and subsequent heating to fuming with H_2SO_4. The solution thus obtained is treated with tartaric acid before being made alkaline and diluted to a known volume, from which an aliquot portion is taken. p-Nitrobenzeneazo-orcinol is added and the optical density relative to a blank is measured on the Spekker absorptiometer. (auth)

Refer also to abstracts 5536, 5539, 5542, and 5579.

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

5543

MENDELEEV PERIODIC SYSTEM AND ATOMIC ELECTRON SHELL STRUCTURE. V. I. Semishin. Zhur. Obshcheĭ Khim. 25, 2375-80(1955) Dec. (In Russian).

A long-period table is proposed for the Mendeleev periodic system, which divides all elements into four basic types or groups (s, p, d and f). In the suggested table, the elements are distributed not only according to the increasing number, but also on the basis of actual electron distributions in atomic sublevels. (R.V.J.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5544 WADC-TR-55-260

Pennsylvania. Univ., Philadelphia. School of Metallurgical Engineering.

DEFORMATION OF SINGLE CRYSTALS OF FERRITE ALLOYED WITH 5% Mo OR 18% Cr. M. L. Wolpert and R. M. Brick. June 1955. 27p. Project Title: METALLIC MATERIALS. Task Title: MECHANICAL BEHAVIOR OF METAL. Contract AF33(038)-15889.

Single crystals of ferrite made from pure iron alloyed with 17.74% chromium were prepared and deformed in tension at room temperature and at −78°C. The slip behavior of the chromium ferrite single crystals was much like that of pure ferrite crystals except that perhaps {112} slip was somewhat more frequent. Like other ferrites, a reduction in the temperature of deformation resulted in an increased tendency for {110} slip in the chromium ferrites. While the chromium ferrite crystals had a critical resolved shear stress at room temperature of about three times as great as that for pure iron, the difference in critical resolved shear stress was quite small at −78°C. This implies that at still lower temperatures, the presence of chromium would make the ferrite crystal weaker than that of pure iron. Data on the molybdenum ferrite crystals were limited to observations of active slip systems and in this respect, the presence of molybdenum showed no definite effect, i.e., the active slip plane, as in the case of pure ferrite, may be anywhere in the <111> zone. (J.E.D.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

5545 AERE-Lib/Trans-662

ON THE "NORMAL POTENTIAL" OF DEUTERIUM. E. Abel and O. Redlich. Translated by G. Luzky from Z. Elektrochem. 44, 204-5(1938). 5p.

The conception of normal potential has been used for deuterium in different ways. Several definitions are discussed. The value of the normal potential is calculated in the usual way. (auth)

5546

INVESTIGATION OF "BITTERNS" AS A SOURCE FOR HEAVY WATER. E. Weingaertner and R. L. Datta (Indian Inst. of Science, Bangalore). J. Indian Inst. Sci. 38, 73-86 (1956) Jan.

The D_2O content of "Bitterns", the water remaining in the mother liquid of the solar evaporation process, is determined, mass-spectrometrically, to be ~0.0208 mol.% and is compared with natural H_2O sources having a D_2O content of 0.0140 to 0.0150 mol.%. Similar enrichments are expected in other bodies of water undergoing continuous evaporation. (C.W.H.)

5547

MASS SPECTROMETRIC STUDY OF THE $B_2D_6-B_5H_9$ EXCHANGE REACTION. W. S. Koski and Joyce J. Kaufman (Johns Hopkins Univ., Baltimore) and Lewis Friedman and A. P. Irsa (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 24, 221-5(1956) Feb.

The distribution of partially deuterated pentaborane species resulting from the reaction between $B_2D_6-B_5H_9$ and its converse $B_2H_6-B_5D_9$ has been examined mass spectroscopically. It was found that the deuterium is entering the pentaborane by two main processes; namely exchange and synthesis by pyrolysis of B_2H_6. The number of readily exchangeable positions in the B_5H_9 under our experimental conditions is five. If the remaining four hydrogens are exchanging they are doing so at a very much slower rate. Examination of the mass spectrum indicates that the deuteriums

are entering the molecule singly during exchange. Tracer studies with B^{10} indicate that borons are not involved in the exchange. (auth)

5548

ERRATUM: ISOTOPIC REACTION RATES BETWEEN METHYL AND HYDROGEN. J. C. Polanyi (Princeton Univ., N. J.). J. Chem. Phys. 24, 493-4(1956) Feb. (See NSA 9-6918.).

Revised valves are tabulated for the calculated and observed rate constants for the eight isotopic reactions between methyl and hydrogen, which appear in J. Chem. Phys. 23, 1505(1955). (C.W.H.)

5549

ON THE EFFECTS OF SUBSTANCE CHARGE AND SOLVENT DIELECTRIC CONSTANT ON THE RATE OF HYDROGEN EXCHANGE. A. I. Shatenshteĭn and E. A. Yakovleva (Karpov Physico-Chemical Research Inst.) Doklady Akad. Nauk S.S.S.R. 105, 1024-7(1955) Dec. 11. (In Russian).

Laboratory studies with hydrocarbon solutions in liquid deuterioammonium and deuterium bromide have established the dependence of the rate of exchange on the protolytic properties of the substances between which the exchange reaction takes place. A correlation is established between the rate of the hydrogen exchange with the charge of the substance and the dielectric constant of the solvents. These are the parameters determining the state of the acid-base equilibrium. (R.V.J.)

FLUORINE AND FLUORINE COMPOUNDS

5550 AD-50531

Cornell Univ., Ithaca, N. Y.

BASIC STUDIES ON THE CHEMISTRY OF FLUORINE COMPOUNDS. Final Report [for] September 1950 to September 1953. W. T. Miller. Sept. 1954. 147p. For W. M. Kellogg Co. Contract DA-44-109-om-222.

This research was directed toward new methods of synthesis of potentially polymerizable fluorine containing monomers. Radical addition reactions of perhalo olefins, condensation reactions of perhalo compounds, synthesis of fluorinated vinyl ethers and results obtained are described (J.E.D.)

5551 NP-5885

Stanford Research Inst., Menlo Par., Calif.

THE THERMODYNAMIC PROPERTIES OF MOLTEN SALTS. Bimonthly Progress Report No. 6 [for] December [1955]–January [1956]. Orlo E. Myers. Feb. 10, 1956. 9p. SRI Project No. CU-1102. Contract AF33(616)-2558.

The absolute entropies, heats of formation, and free energies of formation of selected salts in the temperature range of 800 to 1900°F were determined. Niobium pentafluoride of adequate purity has been prepared and heat capacity determinations for sample plus calorimeter have been completed in the range 50 to 320°K. Detailed features of a drop calorimeter to extend the range of heat capacity measurements to the boiling point of this material have been fixed; the construction of this facility is expected to be completed in the near future. (auth)

5552 NRL-4429

Naval Research Lab., Washington, D. C.

PARTIALLY FLUORINATED ESTERS AND ETHERS AS TEMPERATURE STABLE LIQUIDS. PART I. SYNTHESIS AND CHARACTERIZATION. P. D. Faurote, C. M. Murphy, and J. G. O'Rear. Aug. 20, 1954. 26p.

A new series of mono-, di-, and triesters of promise for lubricant applications have been prepared from fluoroalkanols of the general formula, $H(CF_2)_nCH_2OH$, where n is 4, 6, 8, and 10. Esters of this series as well as those of the $F(CF_2)_nCH_2OH$ series were prepared in 85 to 95% yields by direct esterification procedures in a reasonable length of time. Ether derivatives of the $H(CF_2)_nCH_2OH$ alcohols were prepared in 40% yields by aqueous alkylation methods. The following physical and chemical constants were determined: boiling point, freezing point, density, refractive index, surface tension, molecular refraction, and where applicable, saponification number. Esters from both fluoroalcohol series have exceptionally good hydrolytic stabilities. The anomalously high boiling points, refractive indexes, and surface tensions of dibasic acid esters of $H(CF_2)_nCH_2OH$ alcohols are manifestations of some sort of association involving the terminal hydrogen. Preference is given to the latter class of esters for lubricant applications because of their wider liquidus range, greater potential availability, and lower cost. (auth)

5553

USE OF MASS SPECTROMETRIC APPEARANCE POTENTIALS IN THERMOCHEMICAL CALCULATIONS. II. CHLOROFLUOROMETHANES AND THE DISSOCIATION ENERGY OF FLUORINE. John L. Margrave (Univ. of Wisconsin, Madison). J. Chem. Phys. 24, 476-7(1956) Feb.

Appearance potentials for chlorfluoromethanes and calculated values of the dissociation energy of fluorine are tabulated. A subtraction method which utilizes difference in appearance potentials was used to estimate the dissociation energies. (C.W.H.)

5554

AN APPROXIMATE ENTROPY DIAGRAM FOR UF_6. F. I. Havlíček. Z. Naturforsch. 11a, 99(1956) Jan. (In German).

Refer also to abstracts 5698, 6055, 6057, and 6059.

GRAPHITE

Refer to abstract 6092.

LABORATORIES AND EQUIPMENT

5555

MOISTURE PERMEABILITY OF GLOVE MATERIALS FOR CONTROLLED-ATMOSPHERE BOXES. J. H. Rowan (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Anal. Chem. 28 402-3(1956) Mar.

The moisture permeability of glove materials has been found to be the limiting factor in the maintenance of dry atmosphere boxes. A comparison of available materials for this use has shown the superiority of butyl rubber over all other materials tested. (auth)

5556

REMOTE TONGS ADAPTED FOR THE SMALL RADIOISOTOPE LABORATORY. L. E. Preuss (Edsel B. Ford Inst. for Medical Research, Detroit). Nucleonics 14, No. 3, 79-80(1956) Mar.

Modification of commercial extension cutters for garden use is suggested as an inexpensive source of remote tongs for radioisotope laboratories. (D.E.B.)

MOLECULAR STRUCTURE

5557

A NOTE ON FREE RADICAL FORMATION IN BIOLOGICALLY OCCURRING QUINONES. Scott Blois (Stanford Univ., Calif.). Biochim. et Biophys. Acta 18, 165(1955).

The kinetics of the oxidation-reduction of semiquinones was studied by paramagnetic resonance. It was tentatively concluded that the redox reaction consists of two successive single electron transfers with the formation of a free radical intermediate. (C.W.H.)

5558

TRIARYLAMINIUM SALT FREE RADICALS. Robert I. Walter (Univ. of Connecticut, Storrs). J. Am. Chem. Soc. 77, 5999-6002(1955) Nov. 20.

A series of tri-para-substituted triarylamines has been prepared, and oxidized to the corresponding free radical triarylaminium ions. The products have been isolated as the perchlorates. Some properties of this family of stable free radicals are described. (auth)

5559

COMPLEX IONS IN MOLTEN SALTS. IONIC ASSOCIATION AND COMMON ION EFFECT. Ervin R. Van Artsdalen (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 60, 172-7 (1956) Feb.

The concepts of complex ion and ideality are considered in the case of molten salt solutions. Freezing point depression measurements in molten $NaNO_3$ as solvent are used to determine the nature and number of ions into which several solutes dissociate. It is demonstrated that a number of salts of relatively simple oxy-acids as well as many other simple salts are stable and remarkably ideal in solution in molten sodium nitrate. Partial dissociation and complex ion formation are shown to exist at high dilution in the case of $PbCl_2$, $CuCl_2$, $CdCl_2$, $ZnCl_2$, and $CdBr_2$. The important species in the solutions appear to be those with zero, two and four chlorines per +2 metal ion. The occurrence of the common ion effect is amply substantiated with these compounds and chloro anions containing the +2 metal exist even at low concentrations. Reactions are proposed which account for the results and equilibrium constants are calculated for these reactions. (auth)

RADIATION CHEMISTRY

5560 BNL-389

Brookhaven National Lab., Upton, N. Y.

FISSION PRODUCTS UTILIZATION. VIII. STUDIES ON THE USE OF RADIATION AS A CATALYST FOR CHEMICAL REACTIONS. Progress Report. D. S. Ballantine and B. Manowitz. May 1956. 25p. $0.25(OTS).

Polyvinylpyrrolidone, has been prepared by gamma irradiation of dilute aqueous solutions of the monomer, N-vinylpyrrolidone. The kinetics of the reaction indicate that rate of polymerization is a function of monomer concentration to the first power, and of intensity to the one-half power. The molecular weight, expressed as an empirical K value, increased with monomer concentration, decreased with increased intensity, and varied widely with the solvent used. Polyester formulations of unsaturated linear polyesters with styrene or other monomers were "cured" by exposure to gamma ray dosages of less than one million rep. The rate of cure is increased by raising the intensity, but appears to be insensitive to increases in temperature between 30° and 80°C. The printability and adhesive properties of polyethylene films have been improved by exposure of films to γ's in an oxygen-containing atmosphere. Hydrocarbon waxes have been irradiated in an attempt to improve physical properties. Evidence of physical changes was obtained only after irradiation dosages in excess of 100 million rep. Butadiene was adsorbed on carbon black and irradiated with gamma. Preliminary results indicate that a polymerization occurred but the results are not completely reproducible. Wood has been impregnated by equilibrium soaking with vinyl monomers which were polymerized in situ by exposure to gamma radiation. Uranyl nitrate has been dissolved in methanol and irradiated for a short period. The fission recoils caused much gassing and slight conversion of the methanol to formaldehyde and ethylene glycol. (For preceding period see BNL-317.) (auth)

5561

PROTON TRANSFER IN THE RADIATION CHEMISTRY OF GASEOUS AMMONIA. Antoine B. Zahlan and Benjamin P. Burtt (Syracuse Univ., N. Y.). J. Chem. Phys. 24, 478(1956) Feb.

The reactions of NH_3^+ and NH_2^+ with NH_3 in the gas phase by proton transfer during alpha irradiation are suggested by recent observations of the effects of pressure and intensity on the net ion yield. (C.W.H.)

5562

THE EFFECT OF OXYGEN ON THE FAST NEUTRON YIELD OF HYDROGEN PEROXIDE IN NEUTRAL WATER. M. Ebert, P. Howard-Flanders, and D. Moore (Hammersmith Hospital, London). Radiation Research 4, 110-16 (1956) Feb.

RADIATION EFFECTS

5563

KINETICS AND PRODUCTS OF THE POLYMERIZATION OF ISOBUTENE UNDER THE ACTION OF α RAYS. W. Mund, Ch. Guidée, and J. Vanderauwera. Bull. classe sci. Acad. roy. Belg. 41, No. 8, 805-15(1955). (In French).

The constant pressure polymerization of isobutene irradiated by radon α particles has given coherent and reproducible manometric data. The combination of these with the cryoscopy of the produce (interpreted by taking the dissolved gas into consideration) as well as with the measurement of the small quantity of hydrogen formed, suggests $C_4H_8 = C_4H_7 + H$ and $C_4H_8 + H = C_4H_7 + H_2$ as the initiative mechanism of the chains. (tr-auth)

5564

CHEMICAL ACTION OF ALPHA RAYS ON CARBON TETRACHLORIDE. W. Mund, P. Huyskens, and J. Debaisieux. Bull. classe sci. Acad. roy. Belg. 41, No. 9, 929-36(1955).

The experimental study of the chemical transformation undergone by CCl_4 in the gaseous phase under the action of α rays was undertaken, being confined however to a qualitative identification concerning one of the products (hexachloroethane). As to the chlorine, it was titrated and it was established that it is formed with an ionic yield of about 0.12. (tr-auth)

SEPARATION PROCEDURES

5565 AECU-3137

Nevada. Univ., Reno. Mackay School of Mines.

INVESTIGATION OF ORGANIC REAGENTS AS COLLECTORS FOR THE FLOTATION OF URANIUM MINERALS. Progress Report No. 1. J. N. Butler and R. J. Morris. July 1, 1954. 20p. Contract AT(49-1)-624. (UN-TR-3).

The means by which a suitable collector or collectors may be developed for the concentration by flotation of uranium minerals in ores are discussed. Preliminary investigations and findings on a number of organic reagents are given. While results at the time of this report was started had all been negative, it is believed that the approach presented to concentration of uranium ores in flotation is a logical one. Information contained herein may be helpful to others working on this problem. (auth)

5566 ORNL-1569

Oak Ridge National Lab., Tenn.

RECOVERY OF URANIUM FROM LIGNITES. Uranium Chemistry of Raw Materials Section Progress Report [for] October 1, 1952 to March 31, 1953. K. B. Brown, C. F. Coleman, and F. A. Schimmel. June 1, 1953. Decl. June 5, 1956. 55p. Contract W-7405-eng-26. $9.30 (ph OTS); $3.60(mf OTS).

Investigations were made of the recovery of U from

uraniferous Dakota lignite, lignite char and various types of lignite ash from Slim Buttes region, S. Dak. Reasonable extractions of U were obtained by direct acid leaching of raw lignite. Acceptable extractions of U from lignite char were not obtained by any of the methods employed. Extractions of U were also obtained from most samples of low-temperature ash by simple acid leaching and $(NH_4)_2CO_3$ carbonate leaching. Studies of lignite fractions were continued to determine the association of the U in the lignite and in the ash. Experimental data are tabulated. (J.E.D.)

5567 ORNL-2099

Oak Ridge National Lab., Tenn.

URANIUM EXTRACTION WITH ORGANONITROGEN COMPOUNDS. Progress Report. D. J. Crouse, K. B. Brown, W. D. Arnold, J. G. Moore, and R. S. Lowrie. May 14, 1956. 68p. Contract W-7405-eng-26. $0.45(OTS).

A detailed study, including experimental data, on U extraction with long chain amines is presented. (For preceding period see ORNL-1734.) (auth)

5568 AEC-tr-2498

PROCESS FOR THE SOLVENT EXTRACTION OF PLUTONIUM FROM URANIUM IRRADIATED IN THE PILES. B. Goldschmidt, P. Regnaut, and I. Prévot. Translated by K. Bevis from Bull. soc. chim. France No. 1, 103-6(1956). 9p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-2666. (L.M.T.)

5569

SEPARATION OF NIOBIUM AND TANTALUM. CONTRIBUTION ON THE STUDY BY PAPER ELECTROPHORESIS. E. Bruninx, J. Eeckhout, and J. Gillis (Univ. of Gand, Belgium). Anal. Chim. Acta 14, 74-88(1956) Jan.

The separation of Nb and Ta on a micro-scale by paper electrophoresis, using oxalic and citric complexes and different buffer solutions has been studied. A fairly good separation is obtained by using oxalic complexes and, as buffer solution, a mixture of citric acid and potassium citrate of pH 3.42 and ionic strength 0.4. Different factors influencing the displacement of ions by paper electrophoresis have been examined. It is shown that, if saturation currents are minimized, the displacement is practically proportional to the time of electrophoresis, and more difficult separations become possible using longer strips. (auth)

5570

SEPARATION OF RADIOACTIVE SILVER-111 FROM PILE-IRRADIATED PALLADIUM. Fred Sicilio and M. C. Peterson (Vanderbilt Univ., Nashville, Tenn.) and Guilford G. Rudolph (Thayer V. A. Hospital, Nashville, Tenn.). Anal. Chem. 28, 365-6(1956) Mar.

Radioactive Ag^{111}, a 1-Mev β emitter with a 7.5-day half life, made by neutron irradiation of Pd metal, was separated in a remotely controlled, shielded, glass apparatus. The Pd metal was dissolved in aqua regia and 20 mg of Ag carrier as the chloride complex was added. The separation involved precipitation of silver chloride by dilution, dissolving again in ammonium hydroxide, followed by reprecipitation. The product was recovered in ammonium hydroxide solution or, if silver nitrate was desired, by metathesis to silver oxide, which was then dissolved in nitric acid. The yields were greater than 90%. The products contained less than 1 γ of Pd, and no activities other than that of Ag^{111} have been detected, even after decaying for 10 half lives. The Ag^{111} content was about 50 mc. in the highest activity product, and tests indicated that the method may be suitable for much larger quantities of Ag^{111}. (auth)

5571

CHEMICAL PROCESSING THE NUCLEAR POWER INDUSTRY. II. HIGH TEMPERATURE PROCESSES. F. S. Martin (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 7, 52-8, 61(1956) Feb.

The application of various high temperature processes to the treatment of nuclear fuels is discussed. The potentialities of different methods are considered in the light of thermodynamic data, and typical experimental results are quoted. (auth)

5572

SELF-DIFFUSION OF SODIUM ION IN A CATION-EXCHANGE RESIN. David Richman and Henry C. Thomas (Yale Univ., New Haven, Conn.). J. Phys. Chem. 60, 237-9(1956) Feb.

By means of a procedure based on diffusion from a well-stirred bath into a long rod, the coefficient of self-diffusion of Na in a cation-exchange resin at chemical equilibrium has been measured. Evidence is presented for the absence of a liquid film effect. The results at two temperatures indicate at least two mechanisms for the transport through the resin: in the absence of Donnan electrolyte an exchange between sites with activation energy about 10 kcal/mol, and a diffusion involving free anion with activation energy about 2 kcal/mol. (auth)

5573

THE EQUILIBRIA BETWEEN TRI-n-OCTYLAMINE AND SULFURIC ACID. Kenneth A. Allen (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 60, 239-45(1956) Feb.

Benzene solutions of tri-n-octylamine have been equilibrated with aqueous sulfuric acid at 25°C. The amine sulfate and bisulfate species remain in the organic phase, and the data are interpreted on the basis of polymerization of these salts. Equilibrium constants for the formation of the normal sulfate and sulfate–bisulfate exchange within the colloid are evaluated, and a hypothesized distribution of free amine between solvent and colloid is shown to lead to a relation of the form of a solubility product for the reaction between free amine and sulfuric acid. (auth)

Refer also to abstracts 5576, 5580, and 5812.

SORPTION PHENOMENA

5574

ADSORPTION DYNAMICS AT HIGH CONCENTRATIONS AND THERMAL EMISSION. O. M. Todes, and Yu. S. Lezin. Doklady Akad. Nauk S.S.S.R. 106, 307-10(1956) Jan. 11. (In Russian).

A theoretical analysis and experimental data on adsorption dynamics of ethyl alcohol and benzol on activated carbon established the existence of two qualitatively different processes of adsorption, and revealed the conditions under which the transition of one process to another takes place. (R.V.J.)

TRANSURANIC ELEMENTS AND COMPOUNDS

5575

TRANSURANIC ELEMENTS. A. K. Lavrukhina. Priroda 44, 13-20(1955) Dec. (In Russian).

A general review of available data on uranium elements and their analogy to rare element properties are discussed. The 5-f shell actinide hypothesis and the magnetic susceptibility of actinides and lanthanides are analyzed. (R.V.J.)

5576

A NEW ELUANT FOR THE SEPARATION OF THE ACTINIDE ELEMENTS. G. R. Choppin, B. G. Harvey, and S. G. Thompson (Univ. of California, Berkeley). J. Inorg. and Nuclear Chem. 2, 66-8(1956) Jan.

The use of ammonium α-hydroxy-isobutyrate as the eluting agent for the separation of the higher actinides from cation resin columns is described. (C.W.H.)

Refer also to abstract 5915.

URANIUM AND URANIUM COMPOUNDS

5577 AERE-C/R-1804

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE FUMELESS DISSOLVING OF URANIUM. G. L. Miles. Jan. 1949. Decl. with deletions Oct. 1955. 10p. (AERE-C/R-298(Rev.)).

Uranium dissolves in HNO_3 in the presence of O_2 without the emission of nitrous oxides. The equation for the overall reaction is, $2U + 3O_2 + 4HNO_3 \rightarrow 2\ UO_2(NO_3)_2 + 2H_2O$. (auth)

5578 AERE-C/R-1874

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PREPARATION OF URANIUM TRIOXIDE BY THERMAL DECOMPOSITION OF URANYL NITRATE. B. A. J. Lister and R. J. Richardson. Oct. 18, 1954. Decl. Jan. 25, 1956. 15p.

This is a declassified (revised) version of AERE-C/R-1535.

The trioxide prepared by thermal decomposition of the nitrate is very different in character from that prepared by decomposition of ammonium diuranate. It has a larger individual particle size (although a smaller aggregrate size distribution), a different crystalline form, and is very much more stable to heat treatment. The exact nature of the trioxide, i.e., its particle size, tap density, etc., varies somewhat with the rate of decomposition. Confirmatory evidence has been obtained for the existence of the nitrate dihydrate, but no other simple stoichiometric compounds have been found to exist during the decomposition. (auth)

5579 IDO-14369

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

COULOMETRIC DETERMINATION OF URANIUM(VI) AT CONTROLLED POTENTIAL. Glenn L. Booman, Wayne B. Holbrook, and James E. Rein. May 1, 1956. 9p. Contract AT(10-1)-205. $0.10(OTS).

Uranium(VI) can be reduced to U^{4+} at a controlled-potential Hg cathode using a potassium citrate-aluminum sulfate or a H_2SO_4 electrolyte. Essentially complete reduction is accomplished in 5 to 10 minutes at room temperature by using a 5-ml capacity electrolysis cell. The method can tolerate Hg^{2+}, Cu^{2+}, Fe^{3+}, and large amounts of HNO_3. A procedure is described for the determination of U which is capable of giving results reliable to less than 0.1% standard deviation in the range from 75 mg to 0.75 mg and having sensitivity extending to a few micrograms. (auth)

5580

STUDIES ON THE EXTRACTION OF METAL COMPLEXES. XXI. THE COMPLEX FORMATION OF THORIUM WITH TROPOLONE. David Dyrssen (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Chem. Scand. 9, No. 10, 1567-74(1955).

Uranium(VI) and Th^{4+} can be separated from trivalent ions (e.g. La^{3+} and Y^{3+}) by extraction with chloroform solutions of tropolone at pH = 2. Data on the formation constants of thorium tropolonate are included. (C.W.H.)

Refer also to abstracts 5521, 5526, 5562, and 5565

WASTE DISPOSAL

5581

BALLS KEEP SOLIDS MOVING. Chem. Eng. 63, No. 3, 120, 122(1956) Mar.

A ball mill-kiln for concentrating fission products in Al_2O_3 produced from the $Al(NO_3)_3$ content of waste is described. The apparatus, combining a ball mill and a rotary kiln, is designed for continuous operation. (C.W.H.)

ENGINEERING

5582 AECU-3180

Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.

CHARACTERISTICS OF VARIOUS CHECK AND ANGLE STOP VALVES IN AN EIGHT-INCH WATER LINE. Technical Report No. 5. Allan T. Gifford, Ronald E. Nece, and Richard E. DuBois. Aug. 1953. 121p. Contract AT(30-3)-76. $0.60(OTS).

The results are presented of water tests conducted on five different 8-in. valves of non-conventional design: one swing check valve, two ball check valves, and two angle stop valves. The hydraulic characteristics of all five valves were studied under steady-state flow conditions, with tests conducted on the valves as originally designed and on modified versions, when design changes were necessary in order to improve their hydraulic characteristics. Test results include head loss data across the valves for both forward and reverse flows; for the swing check valve these data are correlated with valve clapper angle, and for the stop valves with the degree of opening. Transient pressure measurements were made on the swing check valve and on one of the ball check valves under conditions of sudden closure caused by accelerated reverse flows through the valve. Reverse flow leakage rates were measured for the check valves. The testing program was conducted in an 8-inch pipeline, with flow rates ranging from 20 to 2000 gpm. The test loop for the check valve tests consisted of a straight horizontal line or a straight line broken by a loop having flow directed upward, then downward, at angles of 60° with the horizontal, the test valve being located in the inclined sections. For the angle stop valves, the loop was horizontal with the test valves being located at a 90° bend in the line. In all cases, the line was fitted with pressure taps for at least 20 ft upstream and 30 ft downstream from the test valve, with a large number of taps at and near the valve, to allow the determination of the gradient throughout the entire test section. The pressure taps were connected to a central piezometer board, with the pressure gradient data being taken photographically. (auth)

5583 NP-5886

Mine Safety Appliances Co., Callery, Penna.

PROGRESS REPORT NO. 32 FOR DECEMBER 1955 AND JANUARY 1956. W. J. Posey, ed. Feb. 9, 1956. 72p. Contract NObs-65426.

Tests were continued on the 3-Mw steam generator. Progress is reported on the following: heat-transfer-system component development; resistance of reactor components to thermal shock; removal of entrained gas; nitriding of loop materials in Na systems; organic coolants in reactor systems; and stainless steel corrosion by NaK. The corrosion and solubility of Zr in sodium was determined as a function of oxygen concentration. Radiation hazards arising from leaks in reactor cooling systems and the effects of wall surface on mass transport of steel by Na were also investigated. (For preceding period see NP-5840.) (C.W.H.)

5584 NP-6000

Utah. Univ., Salt Lake City. Coll. of Engineering.

THE DESIGN OF PRESSURE VESSELS FOR EXTREME PRESSURE. Technical Report No. LI. Wayne S. Brown and S. S. Kistler. June 1, 1956. 55p. Project No. NR-052-357. Contract Nonr-1288 (02).

Elastic theory was found to be useful in gaining insight in stresses in vessels designed for extreme pressure. High pressures must be retained by tensile members, the design of which can be accomplished through elastic theory. Weak materials are useful in high pressure design since there is no indication that they distribute stresses h ·ro-statically even when fragmented. Powders are found to support loads in a columnar fashion. (F.S.)

5585 NP-6003
Standard Oil Co. of Indiana, Whiting.
DEVELOPMENT OF THICKENERS FOR HIGH TEMPERATURE GREASES. Quarterly Progress Report No. 18 [for] October 10, 1955 to January 10, 1956. Robert S. Barnes, John C. Goossens, and Edward A. Swakon. Jan. 1956. 12p. Contract AF33(038)-23687.

Monthly Progress Report No. 56 is incorporated with this report and will not be submitted separately.

Thickeners are being synthesized and evaluated for use in greases for temperatures in excess of 450°F and as high as 700°F. Until fluids suitable for use in this temperature range are available, this work is being guided by a knowledge of the general requirements for the desired thickeners. The following are some of the properties deemed necessary for a good high-temperature thickener: high melting point, small particle size, thickening ability, stability against oxidation, agglomeration, and crystal growth, and chemical inertness to lubricating fluids and bearing metals over the desired temperature range. Organic compounds with melting points above 650°F which can be prepared relatively easily from available starting materials are being prepared and screened as potential thickeners. (auth)

5586 NP-6004
Standard Oil Co. of Indiana, Whiting.
DEVELOPMENT OF THICKENERS FOR HIGH TEMPERATURE GREASES. Quarterly Progress Report No. 19 [for] January 10, 1956 to April 10, 1956. Robert S. Barnes and John C. Goossens. Apr. 1956. 8p. Contract AF33(038)-23687.

Monthly Progress Report No. 59 is incorporated with this report and will not be issued separately.

5587 NYO-7178
Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Progress Report. Apr. 30, 1956. 56p. Contract AT(30-1)-956. (MITS-31). $9.30(ph OTS); $3.60(mf OTS).

Adsorption of flotation agents on AgI, electrochemical studies of adsorption of Ag_2S surfaces, adsorption of xanthate on Ag_2S, studies on the solubility of quartz, and the steaming potential study on corundum, were reported. A study was made of the solvent extraction of Co, flotation of sphalerite, slime coating studies on galena, flotation kinetics, the solubility of gypsum in glycerin–water mixtures, comminution studies in a vibratory ball mill, and brittle fracture patterns. (For preceding period see NYO-7175.) (J.E.D.)

5588 WADC-TR-55-30(Pt.4)
Pennsylvania State Univ., University Park. Petroleum Refining Lab.
FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. Final Report for October 1954 through December 1955. E. Erwin Klaus and Merrell R. Fenske. Feb. 1956. 324p. Contract AF33(616)-2851.

(For preceding period see WADC-TR-55-30(Pt.3).)

5589 WADC-TR-56-254
Pennsylvania State Univ., University Park. Petroleum Refining Lab.
MINERAL OILS AS HIGH TEMPERATURE FLUIDS AND LUBRICANTS. [Summary Report for] October 1951 through December 1955. E. Erwin Klaus and Merrell R. Fenske. June 1956. 38p. Project title: AVIATION LUBRICANTS. Task title: LUBRICANTS. Contract AF33(616)-2851.

In a survey of fluids and lubricants for use at 400 to 700°F., certain types of mineral oils were found to be among the most promising materials studied. While synthetic lubricants have better performance characteristics than most mineral oils and hydrocarbons in the moderate temperature range (200 to 400°F.), they do not possess this margin of superiority in the high temperature range (400 to 700°F.). Certain synthetics have better viscosity-volatility and viscosity-temperature characteristics than hydrocarbons. Some mineral oils and diesters of the Spec. MIL-L-7808 type have good lubricity properties at high temperatures. Using a hydraulic pump and a laboratory wear tester, it has been found that there are lubricity additives that are still effective at 500 to 700°F. in mineral oils and diesters. Mineral oils and certain types of hydrocarbons have better thermal stability and oxygen tolerance than many synthetics at 600 to 700°F. The concept of oxidation stability, or inertness toward oxygen, is not normally applicable at these temperatures. Oxidation rate and oxygen tolerance are better criteria for judging oxidative deterioration at 500 to 700°F. Some additives and additional refining techniques (such as hydrogenation) will be beneficial in improving the oxidation behavior of mineral oils and certain other hydrocarbons at moderate and high temperatures. The thermal and oxidative components of high temperature coking on metal surfaces are demonstrated in a controlled atmosphere panel coker. In a lubrication system where the oil is used for a limited time and then discarded (perhaps to the burners) it is necessary to know the effect of contaminating the fresh oil with oxidized or deteriorated oil. Data have been obtained indicating that this effect need not be serious with esters and mineral oils at 500°F. (auth)

Refer also to abstract 5581.

HEAT TRANSFER AND FLUID FLOW

5590 AD-59951
Massachusetts Inst. of Tech., Cambridge. Aero-Elastic and Structures Research Lab.
APPLICATION OF THE VARIATIONAL METHOD TO TRANSIENT HEAT CONDUCTION PROBLEMS. Technical Report 25-17. K. Washizu. Mar. 1955. 22p. ONR Project NR-064-259. Contract N5ori-07833.

A variational procedure is applied to the problem of determining approximate transient temperature distributions. A simple example is given, and the agreement with the rigorous solution is fairly good. (auth)

5591 AFCRC-TR-55-277
New York Univ., New York. Coll. of Engineering.
EXPERIMENTAL STUDIES OF SMALL SCALE TURBULENCE. Final Report. James E. Miller, Alfred K. Blackadar, Wancheng Chiu, and Warren A. Dryden. Aug. 1955. 145p. Contract AF 19(122)-261. (AD-74332).

Small scale turbulence in air has been studied by means of a specially devised photographic technique. The basic theory, derived from Reynolds' theory, defines the turbulent quantities as natural results of averaging the equations of motion. Many of these quantities are computed in a number of controlled experiments from an analysis of air motions observed by photographing the trajectories of small airborne particles. The spectrum of eddy energy and its rate of dissipation are determined for one of the experiments. A function representing the rate of transformation

of mean energy into eddy energy is computed and discussed. Eddy thermodynamics and the flux of eddy energy are investigated theoretically and by means of data from experiments of this project and other experiments. (auth)

5592 CF-54-11-63
Oak Ridge National Lab., Tenn.
A METHOD FOR EVALUATING THE HEAT TRANSFER EFFECTIVENESS OF REACTOR COOLANTS. M. W. Rosenthal, H. F. Poppendiek, and M. R. Burnett. Nov. 4, 1954. Decl. Nov. 4, 1955. 41p. Contract [W-7405-eng-26]. $7.30(ph OTS); $3.30(mf OTS).

One of the considerations in the selection of a coolant for a nuclear reactor or any heat exchange system is the amount of flow work required for removal of a unit of heat. This quantity, which is referred to as the "cooling work modulus", varies with the geometry of the system, the fluid velocity (and flow regime), and the properties of the fluid. Equations for calculation of the cooling work modulus are developed for turbulent flow, curves which simplify computation are provided, and the results of the study of a specific reactor are presented for illustration. (auth)

5593 KAPL-1494
Knolls Atomic Power Lab., Schenectady, N. Y.
TURBULENT FREE CONVECTION HEAT TRANSFER RATES IN A HORIZONTAL PIPE. J. P. Fraser and D. J. Oakley. Feb. 28, 1956. 51p. Contract W-31-109-Eng-52. $7.80(ph OTS); $3.30(mf OTS).

Heat transfer rates are reported for turbulent free convection in a finite length of horizontal pipe containing Na. Heat is added at one end and removed at the other. A generalized equation which correlates the data is proposed giving the ratio of heat transfer with turbulent convection to that based on pure conduction in terms of the L/D ratio, Prandtl number, Grashoff number, and Reynolds' number. The solution is extended to inclined pipe with one or both ends open to plenums. (auth)

5594 NACA-1210
Lewis Flight Propulsion Lab., Cleveland.
ANALYSIS OF TURBULENT HEAT TRANSFER, MASS TRANSFER, AND FRICTION IN SMOOTH TUBES AT HIGH PRANDTL AND SCHMIDT NUMBERS. Robert G. Deissler, 1955. 16p.

This report supersedes NACA-TN-3145.

The expression for eddy diffusivity from a previous analysis was modified in order to account for the effect of kinematic viscosity in reducing the turbulence in the region close to a wall. By using the modified expression, good agreement was obtained between predicted and experimental results for heat and mass transfer at Prandtl and Schmidt numbers between 0.5 and 3000. The effects of length-to-diameter ratio and of variable viscosity were also investigated for a wide range of Prandtl numbers. (auth)

5595 NACA-TN-3584
Lewis Flight Propulsion Lab., Cleveland.
FREE-CONVECTION EFFECTS ON HEAT TRANSFER FOR TURBULENT FLOW THROUGH A VERTICAL TUBE. E. R. G. Eckert, Anthony J. Diaguila, and John N. B. Livingood. Sept. 15, 1955. 24p.

Experimental heat-transfer data for the turbulent flow of fluids through stationary vertical tubes with both small and large length-to-diameter ratios (to 40) are compared. The limits of the different flow regions, originally established for a tube with small length-to-diameter ratio, apply on the basis of existing data for a tube with large length-to-diameter ratio. (auth)

5596 NP-5872
Mine Safety Appliances Co., Callery, Penna.
REPORT NO. 1 ON 1000 KW SYSTEM. Memorandum Report No. 49. R. A. Tidball, F. L. Mangold, and S. N. Tower. Oct. 15, 1953. 14p.

The 1000-kw heat transfer system was designed to test pilot plant size liquid metal system components at temperatures to 1400°F. The test program was divided into phases: transferring heat to air and transferring heat to boiling water. Two liquid metal systems to prevent exposing the tubes of the liquid metal heater to full steam pressure in event of a failure of the steam generating equipment were used. The air cooled system is shown schematically. The NaK was circulated by a rotary magnet pump, through a flow meter into the NaK heater. The discharge from the heater was piped to the tube side of the intermediate heat exchanger, and returned to the pump. Sodium was circulated by a DC conduction pump, through the flow meter, the shell side of the intermediate heat exchanger, a swing check valve to the sodium cooler. Discharge of the sodium cooler passed through a stop valve, an a-c conduction pump to the suction of the d-c pump. The sodium was cooled by an air blast over finned tubes. Both NaK and sodium systems were fitted with diffusion type cold traps, expansion tanks, and emergency dump tanks. The sodium piping was fitted with tubular heaters (strapped to the outer surface) to preheat the piping before charging. Tests of the major components of this unit at various loads and temperatures are reported. (auth)

5597 NP-5878
Minnesota. Univ., Minneapolis. Heat Transfer Lab.
EXPERIMENTAL STUDY OF THE VELOCITY AND TEMPERATURE DISTRIBUTION IN A HIGH VELOCITY VORTEX TYPE FLOW. Technical Report No. 6. E. R. G. Eckert and J. P. Hartnett. Sept. 1955. 80p. Project title: INVESTIGATION OF THE ENERGY DISTRIBUTION IN A HIGH VELOCITY VORTEX TYPE FLOW. Contract DA-11-022-ORD-1507.

The objective was to obtain a detailed knowledge of the temperature and flow fields in a vortex type flow. The study was restricted to a vortex which is generated at the nozzle cross section and proceeds in one main direction down the tube to be discharged through the exit at the far end of the tube. The exit geometry, in general, consisted of the cone-shaped valve, however, to demonstrate the effects of this boundary on the flow field, limited data were obtained with two other exit geometries and these data will be explicitly identified. The "cold end" orifice was completely closed during the studies reported herein. (auth)

5598 UD-FB-7
Delaware. Univ., Newark.
HEAT TRANSFER TO BOILING LIQUID UNDER CONDITIONS OF HIGH TEMPERATURE DIFFERENCE AND FORCED CONVECTION. Interim Technical Report. O. P. Bergelin and S. Rankin. June 5, 1956. 24p. DA Project No. 5B99-01-004. Contract DA-36-034-ORD-1797.

Surface roughness is shown to have a definite effect upon heat flux in the trasitional region between nucleate and film boiling. This effect apparently continues into the film boiling region. As the surface roughness increases, the rate of fouling increases. Photographs of film boiling show irregular wavy roughness of the interface between liquid and vapor. The interface appears to become smoother as the temperature driving force increases. Within the transitional zone as roughness increases there is a greater tendency for the boiling to fluctuate between nucleate and partial film boiling. (auth)

5599 AERE-Lib/Trans-592
INVESTIGATIONS ON AN EVAPORATIVE CONDENSER. R. Coers. Translated by R. J. Richardson from Kältetechnik 7, 34-8; 71-4(1955). 21p.

A condenser provided with a finned tube system was operated with air cooling alone, and with fresh water cooling alone, as an evaporative condenser, and as a reflux condenser. The measured results showed the strong influence of largely unobserved construction details, and gave support to consideration of these, for calculation purposes. (auth)

5600 AERE-Lib/Trans-659
ON A METHOD OF IMPROVING HEAT EXCHANGE BY FORCED CONVECTION (REGION OF TURBULENT FLOW). E. Fournel. Translated by L. A. Husain from IV Congr. Intern. chauffage ind. Paris, 1952. Groupe 1, Section 13, No. 55. 12p.

Experiments have been carried out using a simple process which increases the heat transfer, by forced convection, between a fluid and a surface in the region of turbulent flow. This increase is accompanied by a saving in friction loss. The process esentially consists of attaching to the exchange surface, wires of a suitable diameter arranged so as to induce turbulence in the laminar boundary layer of the fluid. It is known that the presence of this layer constitutes the main resistance to heat flow. It is shown, in the case of air flowing in a rectangular duct, that the presence of wires on the exchange surfaces results in, all things being equal, approximately halving the pumping power for a given heat exchange, an increase of about 25% in the heat flow for a given pumping power, and nearly doubling the convection coefficient for a given air flow. The first two results were obtained using the same wire pattern (investigation into power economy), the last using another pattern (investigation into convection improvement only). (auth)

5601 IGRL-T/R-4
ON THE EFFECT OF ANGLE OF SLOPE ON THE TEMPERATURE STATE OF THE WALL OF STEAM GENERATING TUBES AT HIGH PRESSURES. M. A. Styrikovitch and Z. L. Miropolskii. Translated by E. Bevitt from Doklady Akad Nauk S.S.S.R. 80, 57-60(1951). 4p.

5602 IGRL-T/R-5
ON THE MAXIMUM HEAT FLUX ON BOILING WATER UNDER HIGH AND SUPERHIGH PRESSURES. E. A. Kazakova. Translated by E. Bevitt from Doklady Akad. Nauk S.S.S.R. 71, 53-5(1950). 4p.

Values of the heat transfer coefficient for boiling H_2O under pressures from 1 to 200 atm. were determined. Experimental techniques are described, and results are plotted. (D.E.B.)

5603
TURBULENT BOUNDARY LAYER GAS FLOW ON A FLAT PLATE. L. E. Kalikhman. Doklady Akad. Nauk S.S.S.R. 106, 23-6(1956) Jan. 1. (In Russian).

5604
UNSTEADY FLOW OF VISCOUS INCOMPRESSIBLE FLUIDS IN A BOUNDED THREE-DIMENSIONAL REGION. A. A. Kiselev (Leningrad State Pedagogical Inst.) Doklady Akad. Nauk S.S.S.R. 106, 27-30(1956) Jan. 1. (In Russian).

5605
SOME ENGINEERING APPLICATIONS OF MAGNETO-HYDRODYNAMICS. J. A. Shercliff (Univ. of Cambridge, England). Proc. Roy. Soc. (London) A233, 396-401(1955) Dec. 29.

The sensitivity of an electromagnetic flowmeter depends on the form of the velocity profile, which is affected by upstream conditions and, when the fluid is a highly conducting liquid metal, by magneto-hydrodynamic forces. The steady state of the velocity profile and the distance necessary for it to be reached are predicted and compared with experiment. Other results concern the settling of the motion in a flowmeter downstream of an obstruction. (auth)

Refer also to abstracts 5628 and 5806.

MATERIALS TESTING

5606 AD-58304
American Helicopter Div., Fairchild Engine and Airplane Corp., Manhatten Beach, Calif.
TESTS OF A NEW RESISTANCE WIRE STRAIN GAGE FOR HIGH TEMPERATURE APPLICATION. Report No. 1949T-001. R. E. George. Oct. 1, 1954. 14p. Contract AF-33(600)-5860y Supplement 5.

Resistance wire strain gages of a new type construction, intended for high-temperature use, were obtained on an experimental basis from Micro-Test,Inc., of Los Angeles, for evaluation tests by American Helicopter. The strain gages were found to be suitable for the measurement of dynamic strains at elevated temperatures. Measurement of static strains at elevated temperatures are beyond the capabilities of the gages in their present form. (auth)

5607 ARDE(M)-2/55
Gt. Brit. Armament Research and Development Establishment, Fort Halstead, Kent, England.
CRAZE-CRACKING IN METALS. PART I. INTRODUCTION AND PRELIMINARY EXPERIMENTS. L. Northcott and H. G. Baron. May 1955. 48p. (AD-71770).

Craze-cracking is a form of surface failure produced by repeated thermal stresses. Published work on both the practical and fundamental aspects of craze-cracking is reviewed, and preliminary experiments in an investigation of this phenomena are then described. The work is mainly concerned with the cracking produced in steels when high surface temperatures (over 700°C) are attained. In the experimental method now being used, one face of a small test piece is intermittently heated by high-frequency induction whilst the main body of the test piece is continuously water-cooled. A brief summary is given of the results so far obtained and graphs are presented which show the approximate stresses and strains set up in a low alloy steel during various thermal cycles. (auth)

5608 CCL-6.1
Virginia. Univ., Charlottesville. [Cobb Chemical Lab.]
EVALUATION OF HIGH TEMPERATURE ANTIOXIDANTS IN SYNTHETIC FLUIDS. Quarterly Progress Report No. 1 [for] October 1, 1955 to January 1, 1956. James W. Cole, Jr. and Donald R. Campbell. 18p. Project No. 6(1-3044). Contract AF33(616)-3234.

Investigations were continued on the oxidative stability of aryl phosphates, silicones, pentaerythritol esters, and other synthetic fluids at elevated temperatures. (C.W.H.)

5609 DP-153
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
A NONDESTRUCTIVE TEST FOR INTERGRANULAR CORROSION IN STAINLESS STEEL TUBING. Richard C. Robinson. Mar. 1956. 15p. Contract AT(07-2)-1. $0.20 (OTS).

An eddy current instrument is described which indicates the relative degree of intergranular corrosion present in austenitic stainless steel tubes. The instrument is applicable to the testing of installed tubing. Differences in resistivity of 1% were detected between sample tubes and standard tubes of stainless steel. A sample judged to have very slight intergranular corrosion showed a 14% increase in resistance while a severely corroded sample showed a 286% increase. (auth)

5610 EES-060088E
Naval Engineering Experiment Station, Annapolis.
EVALUATION OF WELDED JOINTS BETWEEN AISI 347 STAINLESS STEEL AND 70-30 COPPER–NICKEL ALLOY TUBES UNDER THERMAL SHOCK. Specimen No. 3. W. E. Clautice and R. W. Stevens. May 23, 1955. 71p.

Results of thermal shocking welded bimetallic joints between stainless steel and Cu–Ni alloys in heat exchangers showed cracks in the root of one of the bimetallic joints after nine thermal shocks. Cracks were detected in the root of the other bimetallic joint in the 1700°F heat-treated section of Cu–Ni base metal after 27 shocks. At 106 shocks cracks were revealed in the "as forged" section of the Cu–Ni base metal. (F.S.)

5611 ME-TR-ORD-1121-2
Illinois. Univ., Urbana.
THE MECHANISM OF CRATER WEAR OF CUTTING TOOLS. Final Report [for] December 1, 1952 to August 31, 1955. K. J. Trigger and B. T. Chao. Aug. 31, 1955. 56p. Project title: MECHANISM OF TOOL WEAR. Contract DA-11-022-ORD-1121. (AD-71550).

Machining and wear data for a number of work-tool combinations under diversified cutting conditions are presented to test the general validity of the simple crater wear theory recently proposed by the authors. Many phenomena observed in tool-life study can be better understood in light of the proposed theory. Some practical applications are indicated. (auth)

5612 NOLC-310
Naval Ordnance Lab., Corona, Calif.
HIGH-TEMPERATURE DIELECTRIC MATERIALS. Interim Report No. 8 [for] June–September 1955. Jan. 27, 1956. 34p. (NAVORD-4563).

In the polymerization of diphenylvinylsilane, incremental addition of monomer to a polymerizing system has not led to materials of high molecular weight. By the use of platinum-on-carbon catalysts, materials were obtained in which the silicon-hydrogen bond had virtually disappeared. It was determined by cryoscopic measurements that the bulk of this material was of low molecular weight. The discrepancies between molecular-weight values obtained by infrared measurements and hydrolyzable hydrogen determination have been resolved. In the course of the reaction between $(CF_3)_2PCl_3$ and NH_3, undesirable side reactions occur to such an extent that this synthesis is inutile for the formation of $(CF_3)_2PN$ materials. Since the undesirable reactions occur over a wide range of experimental conditions, efforts along this path have ceased. It has been shown that $(CF_3)_2PCl_3$ undergoes complete thermal decomposition at 135°C, and that PF_5 is formed as one of the principal products. In the effort to prepare CF_3-aluminum compounds, the reaction between CF_3I and $AlCl_3$ has been investigated. The reaction between CF_3COOH and $AlCl_3$ yields $(CF_3COO)_3Al$. (For preceding period see NOL-corona-310.) (auth)

5613 NP-5870
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
RESEARCH ON MINIMUM SCATTER IN FATIGUE TESTING. Final Research Report. Frank A. McClintock. Dec. 28, 1955. 8p. OSR Project No. R-355-10-13. Contract AF 18(600)-895.

It is shown that for fatigue specimens in which the stress can be assumed to vary with longitudinal distance z and depth y according to $S = S_m(1-az^2-gy)$, the mean and standard deviation of the life and position of failure have been calculated for a class of distribution functions representing the strength of the differential elements comprising the specimen. These theoretical results provide a method for checking whether the variability in life at constant stress, or the variability of the rupture stress in the case of Prot testing, arises solely from that due to local inhomogeneities within the material or also arises in part from extraneous factors associated with specimen preparation and testing technique. The theoretical results also provide a framework for estimating how much of the size effect arises from statistical causes. An approximate application of the results to notch specimens is suggested. (auth)

5614 NP-5884
Denver. Univ. Denver Research Inst.
DEVELOPMENT OF "CHAIN TYPE" POLYPHENYL COMPOUNDS FOR USE AS HIGH TEMPERATURE LUBRICANTS AND HYDRAULIC FLUIDS. Quarterly Progress Report No. 3 [for] October 15, 1955 to January 15, 1956. John A. Krimmel and John R. Hobaugh. Jan. 20, 1956. 26p. Project Nos. [AF] 5-(7-7340) and DRI 116. Contract AF33(616)-2939.

The syntheses of selected alkyl derivatives of biphenyl and terphenyl, namely, 4-n-hexylbiphenyl, 4, 4′-di-n-hexylbiphenyl, 4-propyl-m-terphenyl and isomeric isopropylterphenyls are described. The introduction of the alkyl group (s) considerably lowered the melting point of the parent biphenyl or terphenyl hydrocarbon. Preliminary observations indicate that the introduction of these alkyl groups resulted in thermostable compounds. (For preceding period see NP-5830.) (auth)

Refer also to abstract 5552.

PUMPS

5615 AERE-ED/R-1844
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A SINGLE PHASE ANNULAR INDUCTION PUMP FOR LIQUID METALS. D. A. Watt. Jan. 21, 1953. Decl. Jan. 17, 1956. 44p.

This is a declassified version of AERE-CE/R-1090.

An electrodeless single-phase a-c liquid metal pump with combined transformer is described. The principle of operation is discussed and mathematical theory deduced. A design study for a pump producing 60 ft head rise in a sodium circuit at 400°C with a flow rate of 1100 gpm is included. This will have an annular pumping channel of nearly 12 ins. mean diameter, ½ in. internal width and length 2½ ins. An electrical efficiency of 30 to 35% can be expected with an over-all efficiency of 20 to 25%. The pump is designed to be operated from 415-volt single-phase mains; about 110 kva will be required with an over-all power factor near 0.5. A note is appended on the general theory of a-c conduction pumps. (auth)

5616 AWRE-O-4/54
Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
PORTABLE LABORATORY VACUUM PUMP. A. Bury. Jan. 4, 1954. 6p.

A portable unit employing a recirculating H_2O system and a vacuum H_2O jet is described. (D.E.B.)

MINERALOGY, METALLURGY, AND CERAMICS

5617 ORNL-2051
Oak Ridge National Lab., Tenn.
SOLID STATE DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING FEBRUARY 29, 1956. June

22, 1956. 72p. Contract W-7405-eng-26. $10.80(ph OTS); $3.90(mf OTS).

Progress is reported on solid state reactions, engineering properties, radiation metallurgy, chemical effects of nuclear reactions, effects of radiation on electrical insulation, radiation effects in barriers and thermal conductivity of dielectrics at low temperatures. (F.S.)

5618

ABUNDANCES OF THE ELEMENTS. Hans E. Suess (U. S. Geological Survey, Washington, D. C.) and Harold C. Urey (Univ. of Chicago). Revs. Mod. Phys. 28, 53-74(1956) Jan.

Previously published studies of element abundance are discussed and their results compared with more recent results. Meteorites are believed to give a more accurate indication of element abundance than earth crust sampling. Methods of analysis for available meteorites are discussed. (D.E.B.)

CERAMICS AND REFRACTORIES

5619 WADC-TR-53-17

Ohio State Univ. Research Foundation, Columbus.

DEVELOPMENT, PROPERTIES AND INVESTIGATION OF A CERMET CONTAINING 28% ALUMINA AND 72% CHROMIUM. Thomas S. Shevlin. Dec. 1952. 58p. Contract AF33(616)-3. (AD-4081).

The composition 72% chromium–28% alumina, by weight, and related compositions, are described with respect to their preparation, testing, and behavior in certain investigations. Batches were prepared by wet ball-milling and the dried granules were formed into bar, tensile, and blade specimens by powder-pressing techniques in steel dies and/or by hydrostatic pressure. Appropriate specimen types were employed in determining firing shrinkage, density, modulus-of-rupture from 75 to 2400°F, stress-rupture life in cross-bending and in tension at 1800 and 2000°F, modulus-of-elasticity, tensile strength at 75 to 2200°F, impact resistance, oxidation resistance, thermal expansion, and thermal-shock resistance under conditions of simulated burner blow-out. Stress-rupture and thermal-shock behavior were intensively investigated, while graded joins and the use of extremely fine alumina were explored in a preliminary manner. A marginal thermal-shock record of 540 cycles of simulated burner blowout, a 1000-hour stress-rupture life of 15000 psi in air at 1800°F, and an impact resistance of the same order of magnitude as for potentially useful carbide-base cermets, combined with other test results, indicate the promise of this material for application in aircraft turbines. (auth)

5620 WADC-TR-55-82

New York. State Univ. Coll. of Ceramics, Alfred.

THE HEAT-TREATMENT, REINFORCEMENT, AND CLADDING OF TITANIUM CARBIDE CERMETS. [Period covered] January 1954 to December 1954. A. David Joseph, Karl D. Scheffer, Richard P. Riegert, and James R. Tinlepaugh. Dec. 1954. 33p. Project title: GAS TURBINE TECHNOLOGY. Task title: CERMET TURBINE BLADING PROGRAM. Contract AF33(616)-2414. (AD-75854).

The effect of heat treatment, metallic reinforcement and cladding on the impact strength of titanium carbide base cermets was studied. A theory has been developed to account for observed changes in microstructure, x-ray parameter and Curie temperature during heat treatment. Major increases in impact strength were obtained by the addition of metal screen or rod reinforcement and by metallic cladding. (auth)

5621 AERE-Lib/Trans-641

THE COMPACTABILITY OF POWDERS OF THE BORIDES, CARBIDES AND NITRIDES OF THE REFRACTORY METALS. G. V. Samsonov and V. S. Neshpor. Translated by R. C. Murray from Doklady Akad. Nauk S.S.S.R. 104, 405-8(1955). 5p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-1407. (F.S.)

5622

AN INVESTIGATION OF BORIDE CERMETS. J. A. Stavrolakis, H. N. Barr, and H. H. Rice (Armour Research Foundation, Chicago). Am. Ceram. Soc. Bull. 35, 47-52 (1956) Feb.

The oxidation resistances of several manganese boride-based cermets at 1100°C were investigated. Silicon additives produced the most oxidation-resistant composites. Silicon–boron mixtures also exhibited high oxidation resistances. Theoretical basis of cermets structure is discussed. (C.W.H.)

CORROSION

5623 ANL-5399

Argonne National Lab., Lemont, Ill.

EFFECT OF ZINC ION ON CORROSION OF 2S ALUMINUM, TYPE 347, AND SAE-1020 STEEL IN STATIC WATER AT 500 F. C. Wohlberg. May 1956. 36p. Contract W-31-109-eng-38. $0.40(OTS).

A series of tests were made to evaluate the influence of zinc ion on the corrosion behavior of Type 347 stainless steel, 2S aluminum, and SAE-1020 steel in static water at 500°F. Liberal composite tabular-pictorial data show various sources of zinc ion—zinc acetate, commercial pigment (Kadox), hydroxide, nitrate, silicofluoride, carbonate, and zinc metal—to be particularly effective for Type 347 in oxygenated water, slightly enhanced in hydrogenated water, partially effective for 2S aluminum, and relatively insignificant in the case of SAE-1020 steel as corrosion inhibitors. (auth)

5624 AERE-C/M-273

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CORROSION AND EROSION OF NICKEL BY MOLTEN CAUSTIC SODA AND SODIUM URANATE SUSPENSIONS UNDER DYNAMIC CONDITIONS. J. N. Gregory, N. Hodge, and J. V. G. Iredale. Mar. 1956. 24p. (RCTC-P/54).

Compared with that measured under static conditions, the corrosion rate of nickel in molten caustic soda under dynamic conditions is approximately 10 times as great. The addition of sodium uranate increases this further by a factor of 3 at 600°C, although at 500° the uranate has no effect. The operation of thermosyphon loops containing molten caustic soda has revealed some of the difficulties and limitations of the system. Under an inert gas atmosphere at temperatures above 600°C, mass transfer of nickel causes complete obstruction of the flow in a few weeks, while at 500°, blocking occurs after about 200 days. In these cases the mass transfer deposit is a higher oxide of nickel whose composition is complex, but approximates to Ni_2O_3. Under a hydrogen atmosphere, loops are slower to plug than those operated under an inert atmosphere at the same temperatures, and here the deposit is found to be pure nickel. (auth)

5625 BM-RI-5189

Bureau of Mines.

GALVANIC CORROSION PROPERTIES OF TITANIUM IN ORGANIC ACIDS. David Schlain, Charles B. Kenahan, and Doris V. Steele. Jan. 1956. 20p.

The galvanic corrosion properties of titanium in contact with commercially pure aluminum, copper, or type 302 stainless steel in some of the common organic acids were

investigated. Acids used in these experiments were 10% formic, acetic, lactic, citric; 1% oxalic and tartaric; and 9% oxalic. Electrode-potential measurements and several types of galvanic couple experiments were carried out. Solutions were aerated by three methods: flow of air, flow of helium, and natural aeration. Work was done at 35°C with couples consisting of equal areas of the 2 metals. Titanium was resistant to corrosion in most of the organic acids studied, whether alone or in contact with a dissimilar metal. However, titanium coupled with aluminum did corrode in 1 and 9% oxalic acid solutions. Contact with titanium usually caused aluminum to corrode by galvanic action. Copper was subject to galvanic attack in 10% acetic acid with a flow of air. Contact with aluminum in some solutions in which titanium is ordinarily inert and noble with respect to aluminum caused titanium to corrode. (auth)

5626 CF-56-1-168
Oak Ridge National Lab., Tenn.
DYNAMIC SLURRY CORROSION STUDIES [FOR] QUARTER ENDING JANUARY 31, 1956. E. L. Compere, H. C. Savage, S. A. Reed, G. E. Moore, R. M. Warner, R. M. Pierce, and S. R. Buxton. Mar. 27, 1956. 41p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

Corrosion data are presented for three slurry runs at 300°C on the 100A pump loop using three different preparations of ThO_2. Average circulating concentrations ranged from 581 to 1075 g Th/kg H_2O. Operating problems including some caking and plugging are discussed. One water run was also made. The attack rate by slurries in the pump loop on pin specimens of type 347 stainless steel appears to be proportional to the slurry concentration and to the square of the flow velocity. Platinum, Au, Zircaloy-2, and Ti appear to be attacked relatively less severely than stainless steel, which had a pin corrosion rate of 7 mils/year at 20 ft^3/sec and 100 g Th/kg H_2O. Studies at 250°C in toroids found no effect of increased ThO_2 calcination temperature on the attack rate on type 347 stainless steel, Ti, or Zircaloy-2 at various flow velocities. (auth)

5627 NAA-SR-Memo-557
North American Aviation, Inc., [Downey, Calif.]
COMPATIBILITY OF SODIUM AND VARIOUS MATERIALS OF INTEREST IN REACTOR CONSTRUCTION. F. E. Bowman. Jan. 5, 1953. Decl. June 6, 1956. $1.80(ph OTS); $1.80(mf OTS).

Available data relative to the compatibility of Na and various materials of interest in reactor construction are summarized. (J.E.D.)

5628 NRL-4644
Naval Research Lab., Washington, D. C.
A HYDROGEN EFFUSION METHOD FOR THE DETERMINATION OF CORROSION RATES IN AQUEOUS SYSTEMS AT ELEVATED TEMPERATURE AND PRESSURE. M. C. Bloom and M. Krulfeld. Sept. 16, 1955. 17p.

The choice of an aqueous heat exchange system for nuclear power applications necessitated a critical evaluation of materials suitable for such heat exchanger construction. Exploratory work revealed the need for an improved technique for the determination of the resistance of metals to attack by aqueous media at elevated temperature and pressure. An analysis of the limitations of prior techniques of corrosion rate measurement and a description of a new technique based on the fact that, in a closed system at elevated temperature the hydrogen which results from the corrosion reaction (Metal + $H_2O \rightarrow$ Metal Oxide + 2H) will diffuse through the walls of the metal at a comparatively rapid rate are presented. This hydrogen is collected and measured in a vacuum system of known volume which surrounds the system under test, and the rate of hydrogen evolution thus measured gives a direct measure of the rate of corrosion of the metal. Results obtained show good reproducibility and compare well with results obtained by an independent method. (auth)

5629 NRL-Trans-554
MECHANISM OF THE PASSIVATION OF METALS IN OXIDIZING MEDIA. (Medhanism samopassivirovaniya metallov v okislitel'nykh sredakh). V. P. Batrakov. Translated by A. Pingell from Doklady Akad. Nauk SSSR, 99, 797-800(1954). 8p.

The mechanism of passivation of metals was examined from the position that the phenomenon of self-passivation is analogous to that of anodic passivity when external current is applied and that anodic and cathodic areas exist on metals. (F.S.)

Refer also to abstracts 5668 and 5714.

GEOLOGY AND MINERALOGY

5630 NYO-6068
Pennsylvania State Univ., University Park. Coll. of Mineral Industries.
AN INVESTIGATION OF THE MINERALOGY, PETROGRAPHY AND PALEOBOTANY OF URANIUM-BEARING SHALES AND LIGNITES. SCOPE A—SHALES. Fourth Annual Report for the Period of April 1, 1954 to March 31, 1955. E. O. Strahl, E. N. Silverman, R. L. O'Neil, H. D. Duey, J. C. Griffiths, H. D. Wright, and T. F. Bates. Mar. 31, 1955. 79p. Project E-32. Contract AT(30-1)-1202.

Samples from drill cores YB-4 and YB-19 of the Youngs Bend coring area east of Nashville, Tenn. have been analyzed quantitatively and evaluated mineralogically. X-ray orientation studies have been made of YB-4 samples. Qualitative studies of important mineral and organic components have been continued as have the investigations of alpha track distribution in thin and polished sections. Research has been initiated on the use of fission fragment tracks to shorten exposure times and to locate U^{235} in shale thin sections. In the two cores studied there is an 85 to 91% association of uranium with total silicates, carbon, and pyrite. Since these make up the bulk of the rock, it is apparent that chemical and mineralogical composition is the most important factor in the control of the present location and concentration of uranium. Analysis of variance shows that, with respect to each of the four components mentioned in the preceding paragraph, the variance between samples in each core is greater than the variance between the two cores. The cores, taken as a whole, are not significantly different. The same applies to the Top Black units of the two cores except in the case of total silicates which do show a significant difference between cores. The results of the research show that it is now possible to proceed with a regional study of the Top Black unit. (auth)

5631 TEM-915
Geological Survey.
A RECONNAISSANCE FOR URANIUM IN CARBONACEOUS ROCKS IN SOUTHWESTERN COLORADO AND PARTS OF NEW MEXICO. Elmer H. Baltz, Jr. Feb. 1955. 51p., 1 illus.

Coal and carbonaceous shale of the Dakota formation of Cretaceous age were examined for radioactivity in the Colorado Plateau of southwestern Colorado and northwestern New Mexico. Older and younger sedimentary rocks and some igneous rocks also were examined, but in less detail. Weak radioactivity was detected at many places but no new deposits of apparent economic importance were discovered. The highest radioactivity of carbo-

naceous rocks was detected in black shale, siltstone, and sandstone of the Paradox member of the Hermosa formation of Pennsylvanian age. A sample collected from this member at the Bald Eagle prospect in Gypsum Valley, San Miguel County, Colo., contains 0.10% uranium. Carbonaceous rocks were investigated at several localities on the Las Vegas Plateau and the Canadian Escarpment in Harding and San Miguel Counties, northeastern New Mexico. Carbonaceous sandstone and siltstone in the middle sandstone member of the Chinle formation of Triassic age contain uranium at a prospect of the Hunt Oil Company southwest of Sabinoso in northeastern San Miguel County, N. Mex. A channel sample across 3.2 ft of mineralized rocks at this locality contains 0.22% uranium. Weak radioactivity was detected at two localities in carbonaceous shale of the Dakota and Purgatoire formations of Cretaceous age. (auth)

5632

A METHOD FOR THE DETERMINATION OF ALPHA-RADIOACTIVITY IN PLANTS AS A TOOL FOR URANIUM PROSPECTING. Roger Y. Anderson and Edwin B. Kurtz, Jr. (Univ. of Arizona, Tucson). Econ. Geol. 51, 64-8(1956) Jan.-Feb.

Scintillation alpha counting has been adapted to the determination of the radioactivity of plant ash for use in uranium prospecting. A system of sample mounting is described which has high sensitivity and good reproducibility. Background for the system is only 6 counts per hour. The method is sufficiently sensitive so that species which accumulate more than 10 ppm uranium in the plant ash can be used for survey studies. (auth)

5633

ON THE DETERMINATION IN THE PRESENCE OF Fe, OF U IN THE PHOSPHATES OF GAFSA (TUNISIA). Roger Lumbroso, Jean Petit, and Joseph Spiteri. Compt. rend. 242, 904-5(1956) Feb. 13. (In French).

Various methods have already been used in order to determine U in Tunisian phosphates. The simple method proposed here allows a determination in the presence of large quantities of Fe with reliable results which were then compared to those obtained by other methods. These values correspond to 0.0023% of elementary U in the total mineral mass. (tr-auth)

5634

AERIAL DETECTION OF RADIOACTIVE MINERAL DEPOSITS. A. F. Gregory. Can. Mining Met. Bull. 48, No. 520, 479-85(1955) Aug.

A resumé of aerial radiation survey studies is presented. Flight tests were initiated in 1947 and were followed by intensified use and study of Geiger counters and other radiation detectors. For the Eldorado detector, several limiting conditions were established for successful radioactivity detection, the most important being that natural vein exposures can only be assuredly detected at distances less than 150 feet. Sedimentary and pegmatitic radioactive occurrences can be detected at much greater distances. A helicopter investigation technique appears to have a useful prospecting potential. (auth)

5635

NATURAL RADIOACTIVITY OF SOILS. H. S. Gibbs and G. J. McCallum. New Zealand J. Sci. Tech. B37, 354-68 (1955) Nov.

The radioactivity of principal horizons of a number of soil types was examined for relationships to properties used in the identification and classification of soil profiles. Techniques for measuring the intensity of gamma radiations in the field and of beta radiations in the laboratory are described. After correction for cosmic ray background the measurements showed a range in gamma counts from 410 to 2420 cpm and in beta counts from 21 to 154 cpm. Correlation of the data and soil profiles showed that the soil radioactivity depends partly on the rock materials from which the profiles are developed and partly on the extent of weathering and leaching of the profiles. Rock materials determine the initial level of radioactivity in a soil—high to moderate count rates being general for C horizons from greywacke, sandstone, siltstone, or deposits of rhyolitic ash beds, and low counts being common on C horizons from dolerite or andesitic ash beds. Reduction of the initial level by weathering or leaching is shown by counts of C horizons of soils developed from the same type of rock decreasing with increasing leaching of the profile, and by count rates within the profiles decreasing from C to B horizon and from B to A horizon. The decreasing count rate up the soil profiles indicates an absence of significant accumulation of radioactive substances in B horizons and of significant circulation of radioactive substances by the plant and animal life. Radioactivity measurements on A horizons are too variable for comparison of profiles. Measurements on B and C horizons of soils developed from greywacke, sandstone, dolerite, and rhyolitic or andesitic volcanic ash beds are suitable for assisting identification of soil types formed from parent materials difficult to distinguish in the field, or for indicating changes of parent materials within a soil profile. As weathering and leaching tend to lessen the differences in count rates between soil types, weakly or moderately weathered and leached soils are recommended for comparisons of natural radioactivity. (auth)

5636

EVALUATION OF THE ACCURACY OF NEW ZEALAND RADIOCARBON DATING RESULTS. G. J. McCallum (Dominion Physical Lab., Wellington, New Zealand). New Zealand J. Sci. Tech. B37, 370-81(1955) Nov.

Operation of the New Zealand radiocarbon-dating equipment is described. The method of evaluating results and sources of possible error in reporting dates is given. The inherent difficulties of the measurement are discussed and future improvements to the apparatus are described. (auth)

5637

URANIUM ORE MINING IN SOUTH AFRICA. Atomics 7, 67-8, 74(1956) Feb.

5638

STRATIGRAPHIC SECTIONS OF THE PHOSPHORIA FORMATION, 1953. R. W. Swanson, L. D. Carswell, R. P. Sheldon, and T. M. Cheney. U. S. Geol. Survey Circ. 375, 1956. 30p.

Analytical data and abstracts of stratigraphic sections measured at 18 localities plus additional information at three previously reported localities are presented. Locations of the outcrops of the formations are shown. (J.E.D.)

5639

GEOLOGY OF THE URAVAN QUADRANGLE, COLORADO. GEOLOGIC QUADRANGLE MAP GQ-78. Fred W. Cater, Jr., A. P. Butler, Jr., and E. J. McKay. Washington, U. S. Geological Survey, 1955.

The Uravan Quadrangle is one of eighteen 7½-minute quadrangles covering the principle carnotite producing area of southwestern Colorado. The rocks exposed in the eighteen quadrangles consist of crystalline rocks of Pre-Cambrian age and sedimentary rocks that range in age from late Paleozoic to Quaternary. Over much of the area the sedimentary rocks are flat lying, but in places the rocks are disrupted by high-angle faults, and northwest-trending folds. Conspicuous among the folds are anticlines having cores of intrusive salt and gypsum. Most of the carnotite deposits are confined to the Salt Wash sandstone member of the Jurassic Morrison formation. Within this sandstone, most of the deposits are spottily distributed through an arcuate zone known as the

Uravan mineral belt. Individual deposits range in size from irregular masses containing only a few tons of ore to large, tabular masses containing many thousands of tons. The ore consists largely of sandstone selectively impregnated and part replaced by U and V minerals. Most of the deposits appear to be related to certain sedimentary structures in sandstones of favorable composition. (auth)

5640

GEOLOGY OF THE JUANITA ARCH QUADRANGLE, COLORADO. GEOLOGICAL QUADRANGLE MAP GQ-81. Eugene M. Shoemaker. Washington, U. S. Geological Survey, 1955.

The Juanita Arch quadrangle is one of eighteen 7-½-minute quadrangles covering the principal carnotite-producing area of southwestern Colorado. The rocks exposed in the eighteen quadrangles consist of crystalline rocks of pre-Cambrian age and sedimentary rocks that range in age from late Paleozoic to Quaternary. Over much of the area the sedimentary rocks are flat lying, but in places the rocks are disrupted by high-angle faults and northwest-trending folds. Conspicuous among the folds are large anticlines having cores of intrusive salt and gypsum. Most of the carnotite deposits are confined to the Salt Wash sandstone member of the Jurassic Morrison formation. Within this sandstone, most of the deposits are spottily distributed through an arcuate zone known as the "Uravan Mineral Belt". Individual deposits range in size from irregular masses containing only a few tons of ore to large, tabular masses containing many thousands of tons. The ore consists largely of sandstone selectively impregnated and in part replaced by uranium and vanadium minerals. Most of the deposits appear to be related to certain sedimentary structures in sandstone of favorable construction. (auth)

5641

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-14 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-120. B. H. Kent. Washington, U. S. Geological Survey, 1956. $0.50.

5642

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-15 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-121. W. R. Hemphill and C. R. Lewis. Washington, U. S. Geological Survey, 1956. $0.50.

5643

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-16 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-122. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

5644

PHOTOGEOLOGIC MAP OF THE WOODSIDE-13 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-123. P. P. Orkild. Washington, U. S. Geological Survey, 1956. $0.50.

5645

PHOTOGEOLOGIC MAP OF THE CASTLE DALE-16 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-124. J. S. Detterman. Washington, U. S. Geological Survey, 1956. $0.50.

5646

GEOLOGIC AND RADIOMETRIC MAPS OF THE McKINLEY MOUNTAIN AREA, WET MOUNTAINS, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-37. Quentin D. Singewald, et al. Washington, U. S. Geological Survey, 1955. 4 sheets.

5647

REGIONAL TECTONICS OF THE COLORADO PLATEAU AND RELATIONSHIP TO THE ORIGIN AND DISTRIBUTION OF URANIUM. UNIVERSITY OF NEW MEXICO PUBLICATIONS IN GEOLOGY NO. 5. Vicent C. Kelley. Albuquerque, University of New Mexico Press, 1955. 120p. plus 1 illus. $2.00.

A study was made of the relationship between regional structure and regional concentration of U deposits of the Colorado plateau. A description and analysis of the regional tectonics, geologic history, and a discussion of the tectonic influence on distribution and origin of U are presented. (J.E.D.)

5648

URANIUM: WHERE IT IS AND HOW TO FIND IT. Paul Dean Proctor, Edmond P. Hyatt, and Kenneth C. Bullock. Salt Lake City, Eagle Rock Publishers, 1954. 85p.

Facts concerning U, economic U minerals and types of deposits, areas in the U.S. worthy of prospecting for U deposits, sources of information for prospecting, field equipment and procedures for locating claims are discussed. (J.E.D.)

Refer also to abstract 6013.

METALS AND METALLURGY

5649 AD-43295

Dow Chemical Co. Metallurgical Labs., Midland, Mich. A STUDY OF THE HARDENING MECHANISM IN Mg–Li BASE ALLOYS. Final Report. Part I (Report No. 15763) and Part II (Report No. 16231). [Aug. 25, 1954]. 62p. Contract NOas 52-018-c.

The hardening reaction has been classified definitely as an age hardening precipitation process. The response of structure and hardness of the β cubic Mg–Li–Al and Mg–Li–Zn alloys with 5 at. % Al or Zn has been studied metallographically and by Debye-Sherrer patterns. The hardening reaction appears to be as follows: β cubic → θ ($MgLi_2X$) → Li X, (where X = Al or Zn, and the arrow → indicates precipitation). The θ ($MgLi_2X$) precipitate is the hardening agent; LiZn precipitate is a product of overaging. The crystallography of this precipitation process has not been determined. Selected additions (Bi, Ca, Ce, Mn, Tl, Pb, Sn, Zr, and Th) were coextruded with four Mg–Li base powders (Mg–4Li, Mg–4Li–4Al, Mg–12Li, and Mg–12Li–6Al). The extrusions were heat treated and tested for mechanical properties. The powder additions are not beneficial to the properties of Mg–Li alloys and in many instances are quite deleterious. Mg–4Li–4Al has the best combination of strength, ductility and stability of the alloys studied. Mg–12Li–6Al has higher strength in the –T4 temper but is brittle and unstable at 180°F. (auth)

5650 AD-67498

Mallory-Sharon Titanium Corp., Niles, Ohio. THE STUDY OF PHYSICAL METALLURGY AND HEAT TREATMENT OF TITANIUM ALLOYS. Final Summary Report [for the Period] March 16, 1954 to March 16, 1955. Richard J. McClintick and G. William Bauer. Mar. 19, 1955. 62p. Titanium Project. Contract NOas-54-371-c.

The heat treatment of Ti alloys is discussed with regard to metallurgical theories and practical heat treatments for annealing and hardening. Typical mechanical properties which can be expected of commercial Ti alloys in the various heat-treated conditions are shown. (auth)

5651 AD-71720

Frankford Arsenal. Pitman-Dunn Labs., Philadelphia. CORRELATION OF LITERATURE ON THE EFFECT OF TESTING TEMPERATURE ON THE MECHANICAL PROPERTIES OF WROUGHT ALUMINUM BASE ALLOYS. Helen R. Pritchard. May 1955. 119p. Project TB4-202A. (R-1268).

A survey of the literature was conducted to determine

the effect of testing temperature on the tensile properties, modulus of elasticity, hardness, and fatigue strength of wrought aluminum base alloys. At subatmospheric temperatures, the tensile and yield strengths, elongation, modulus of elasticity, hardness, and fatigue strength usually show an increase over their room temperature properties. As the temperature decreases below room temperature, there is a great change in ductility. In the majority of instances the elongation shows a slight increase and the reduction of area, a slight decrease. At elevated temperatures, the tensile and yield strengths, modulus of elasticity and fatigue strength decrease with increasing temperature, while the elongation and reduction of area increase. No hardness data were available at elevated temperatures. (auth)

5652 AERE-G/M-13

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

X-RAY INVESTIGATION OF THE PRODUCTS FORMED ON HEATING URANIUM AND ALUMINIUM IN CONTACT. C. S. Lees. Apr. 22, 1948. Decl. Nov. 15, 1955. 7p.

In order to find the conditions which favor reaction between U and Al at moderately high temperatures (300°C and upwards) a number of experiments have been carried out with solid pieces of metal and with powders, and the products have been analyzed by x-ray diffraction. The first experiments showed that considerable care was needed to exclude even small amounts of air, which oxidized the U very readily. With proper exclusion of air, it was then found that some reaction took place if a U block was pressed into contact with an Al block and heated to 400°C for 60 hours, the product being UAl_3. No detectable reaction occurred in the same time at 300°C. (auth)

5653 BM-RI-5178

Bureau of Mines.

ARC-WELDING TITANIUM. J. C. Barrett, R. W. Huber, and I. R. Lane, Jr. Jan. 1956. 50p.

Arc welds in unalloyed titanium can be made with resulting properties comparable to those of the parent metal, if adequate protection from the atmosphere is provided. Adequate protection usually presupposes that the welding be carried out in a chamber filled with inert gas, although there are occasions when open air welding is fairly successful, provided care is taken to protect the weld by a stream of inert gas issuing from the torch and also, if possible, from a trailing shield. The base metal used for welding should have been originally prepared by melting, and it should be homogeneous and of reasonable purity. The weld joint should be so designed that complete penetration can be obtained, and the operator (when hand welds are made) should hold the arc for a longer time over one spot than is usual with other metals because of titanium's high melting point. Use of a consumable filler on heavy gages should make higher welding speeds possible. Welded assemblies of titanium have proved successful in tests involving both strength and corrosion resistance. (auth)

5654 CF-56-4-64

Oak Ridge National Lab., Tenn.

MANUFACTURING U–Al FUEL PLATES CLAD WITH AN INTENDED 99.90 w/o Al–0.10 w/o B ALLOY. R. J. Beaver. Apr. 6; 1956. Decl. May 31, 1956. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Forty plates were fabricated to approximate ETR fuel plates. The 99.9 wt.% Al–0.1 wt.% B alloys as air induction melted with an addition of a master Al–B alloy containing 3 wt.% B exhibits top and bottom segregation in the as-cast slab. Care must be taken to air-induction melt the 0.10 wt.% B–Al alloy in an atmosphere with a relative humidity less than 35%. Hot and cold breakdown of the 0.10 wt.% B–Al slabs reveal that the material rolls much like high purity 99.99 wt.% Al. The 0.10 wt.% B–Al cover plates can be roll bonded to the 11.0 wt.% U–Al fuel alloys with conventional practices. In cladding with the 0.10 wt.% B–Al alloy, results show that the alloy clad reduces more than the fuel core. The uncertainty of B in a fuel plate clad with the 0.10 wt.% B–Al alloy appears to be ± 19.5%. Difficulty was experienced in fabricating plates with straight cores and in shearing the plates. (B.J.H.)

5655 NACA-RM-E54F10

Lewis Flight Propulsion Lab., Cleveland.

PRELIMINARY INVESTIGATION OF STRESS-RUPTURE AND TENSILE STRENGTH OF THERMENOL, AN IRON–ALUMINUM ALLOY. Charles A. Gyorgak. June 17, 1954. 11p.

An investigation determined the stress-rupture life at 1100° and 1200°F, the room-temperature tensile strength, and the bend ductility of the oxidation-resistant iron-aluminum alloy Thermenol. Stress-rupture strengths for 100-hour life were 19,300 psi at 1200°F and 35,500 psi at 1100°F. The room-temperature tensile strength was 62,050 psi with 3-percent elongation in the ¾-inch-gage length. Angles of bend to cause failure in the longitudinal and transverse directions ranged from 34° to 56° and were approximately equal. (auth)

5656 NACA-TN-3595

Lewis Flight Propulsion Lab., Cleveland.

WEAR OF TYPICAL CARBON-BASE SLIDING SEAL MATERIALS AT TEMPERATURES TO 700°F. Robert L. Johnson, Max A. Swikert, and John M. Bailey. Dec. 1, 1955. 22p.

Wear and friction studies were made with carbon-type seal materials sliding against tool steel, stainless steel, and chromium-plated steel at temperatures to 700°F and a sliding velocity of 10,000 feet per minute. Wear was several times greater at 500°F and above than with no heat added for all carbon materials. The mating material had more effect on wear and surface failure than did the use of various impregnants in the carbon. Chromium plate gave less wear than the other mating materials under all conditions of the experiment. (auth)

5657 NP-5871

Langley Aeronautical Lab., Langley Field, Va.

AIRCRAFT STRUCTURES RESEARCH AT ELEVATED TEMPERATURES. John E. Duberg. Aug. 26, 1955. 36p.

A review is made of the test techniques that have been developed and used for experimental research in aircraft structures at elevated temperatures. Some experimental results are presented. Remarks are included on the problem of model scaling for testing of structures at high temperatures. (auth)

5658 NP-5874

Horizons, Inc., Cleveland.

INVESTIGATION OF A NEW METHOD FOR THE DETERMINATION OF THE COEFFICIENTS OF SURFACE DIFFUSION OF METALS. Quarterly Progress Report No. 10. Peter F. Mataich. Jan. 31, 1956. 15p. Project No. R-355-30-2. Contract AF18(600)-644.

A radioactive method for determining the surface diffusion coefficients of metals is presented. Experimental procedures using Au and Ag^{110} diffusion are discussed. (J.E.D.)

5659 NP-5881

Battelle Memorial Inst., Columbus, Ohio.

THE EFFECT OF HYDROGEN ON THE MECHANICAL PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. Summary Report No. 4 [for] August 1, 1954 to July 31, 1955. G. A. Lenning, L. W. Berger, and R. I. Jaffee. July 31, 1955. 58p. Contract DAI-33-019-505-ORD-(P)-1.

Results obtained on unnotched and notched fatigue tests of commercial A-55 and Ti–8Mn titanium alloy indicated that 400 ppm H_2 did not significantly alter the fatigue properties. The effects of H_2 on high-purity-base Ti alloys containing various alpha-stabilizing additions were studied. The low-temperature solubility of H_2 in alpha Ti was increased greatly by the presence of 5% Al. The increase in solubility eliminated the loss in notch toughness caused by hydrogen in alpha Ti. In the investigation of the effect of beta-stabilizing additions on the H_2 tolerance of alpha Ti alloys, a 2% Mo addition showed the most benefit, inasmuch as the H_2 tolerance for high notch-bend impact properties was increased from about 100 to at least 200 ppm. (auth)

5660 NP-5882

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

EFFECT OF VARIATION OF TEMPERATURE AND PRESSURE ON COMPOSITION OF ALLOYS. Final Report [for] January 1, 1954 through December 31, 1955. William M. Spicer. 60p. Project title: STUDY OF THE EFFECT OF THE VARIATION OF TEMPERATURE AND PRESSURE ON THE COMPOSITION OF ALLOYS. Contract AT18(600)-974.

Experiments were performed on several solid alloys in an attempt to show that concentration gradients might develop as a result of a pressure gradient or a temperature gradient. The results on the pressure effect were inconclusive. However, the results on the temperature effect, especially those on the Pb–14.8 wt. % Zn alloys, indicate strongly that a concentration gradient did develop as a result of the temperature gradient. In the case of the Pb–14.8 wt. % Sn alloy, the percentage Sn reached a maximum of 15.71 wt. % near the hot end and a minimum of 13.84 wt. % near the cold end. With the Al–21.9 wt. % Zn alloy, the percentage of Zn attained a maximum of 25.57 wt. % and a minimum of 18.12 wt. % in one of the three runs. (auth)

5661 NP-5888

California. Univ., Berkeley. Minerals Research Lab.

DELAYED YIELDING IN A SUBSTITUTIONAL SOLID SOLUTION ALLOY. L. A. Shepard and J. E. Dorn. Feb. 1, 1956 35p. Contract N7-onr-295, Task Order 11, Technical Report No. 45.

The effects of temperature and stress on the delayed yielding arising for substitutional locking of dislocations in the f-c-c system were investigated. Specimens of an Al alloy containing 2% Mg were prestrained to 25,000 psi at 78°K and then aged for 15 min at 273°K in order to develop a pronounced yield point at 78°K. Delayed yielding tests were performed at 78 and 114°K at a series of constant stresses below the upper yield point observed in a tensile test. The reciprocal of the delay time for the formation of the first Lueder's band and the rate of propagation of the band front were found to be identical functions of the stress and temperature. Consequently, the basic mechanism for the nucleation of a Lueder's band appears to be identical with that for its spread. The delay time for yielding was found to depend on the product of two separable functions of stress and temperature. This observation is in disagreement with the predictions based on thermal activation of interstitially locked dislocations according to the Cottrell and Bilby and the Fisher models. (auth)

5662 NP-5996

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE DUCTILE FRACTURE OF METALS. STRAIN HARDENING OF AUSTENITIC STAINLESS STEEL. Technical Report No. 7. G. W. Powell, E. R. Marshall, and W. A. Backofen. June 1, 1956. 43p. Project No. NR-031-356. Contract N5ori-07841.

Strain-hardening characteristics of austenitic stainless steel have been studied as functions of temperature, strain rate, and stress system, and correlated with quantitative determinations of the progress of a martensitic transformation. The experimental program involved tensile, torsion, and compression testing. Tension is more effective in promoting transformation than either torsion or compression. (F.S.)

5663 OSR-TN-55-404

Franklin Inst. Labs. for Research and Development, Philadelphia.

STUDY OF PURIFICATION AND SUBSTRUCTURE FORMATION OF METALS AND THE PROPERTIES OF HIGH-PURITY METALS. Final Report [for] October 1, 1954 to September 30, 1955. M. Herman, J. Rutherford, and R. L Smith. 28p. Contract AF 18(600)-465. (F-2337-3).

Induction equipment has been constructed for the floating zone technique of zone melting. Iron and Ti have been zone melted by this method and are in the process of being evaluated. Studies of substructure show that lead segregation accounts for the observed substructure and pits formed in etched Zn. It is possible, however, that the lead segregates in the region of a dislocation. The cellular structure is bounded by simple crystallographic planes and not by boundaries that are apparently oriented randomly. (auth)

5664 OSR-TN-56-70

Franklin Inst. Labs. for Research and Development, Philadelphia.

ZONE PURIFICATION OF REACTIVE METALS. Interim Report. R. L. Smith and J. L. Rutherford. Feb. 1, 1956. 37p. (I-A1878-1; AD-81522).

Apparatus and techniques used to zone-melt reactive, high-melting-point metals by the floating zone method are described. The use of radioactive tracers to determine the redistribution of solute during zone melting is discussed and results are shown for P^{32} in iron, Au^{198} in titanium and zirconium, and Zn^{65} in titanium. Some tensile results on Fe at liquid N_2 and liquid He temperatures are given which indicate that the removal of trace impurities may increase markedly the low temperature ductility of Fe. (auth)

5665 OSR-TN-56-103

Brown Univ., Providence. Metals Research Lab.

THE INFLUENCE OF DEFINED SMALL AMOUNTS OF IMPURITIES ON THE RECRYSTALLIZATION OF ALUMINUM. Klaus Detert and Kurt Lücke. Mar. 1, 1956. 36p. Contract AF18(600)-1495. (AD-82016).

The influence of small additions (0.008 to 0.14%) of iron, copper, silicon, magnesium and silver upon the recrystallization of high purity aluminum after rolling of 40% and 90% was investigated with the help of the x-ray method. In all cases the recrystallization has been delayed by the impurities. The effect of the iron turns out to be the largest, additions of the order of 1/100% increasing the recrystallization temperature by 210°C and decreasing the rate of recrystallization by a factor up to 10^{11}. For copper, silicon and magnesium values of the order to 150°C and 10^7 were obtained. The effect of the silver is very much smaller. The activation energy seems to decrease with increasing amount of impurity. It can be shown that the effect is caused by the foreign atoms in solid solution and not by those in precipitations due to direct interaction between the boundaries and the foreign atoms rather than a difference between the deformed states of the pure and impure metal. Both the rate of nucleation and the rate of growth are diminished by the impurities, for small additions both nearly by the same factor. (auth)

5666 55-RL-1356
General Electric Co. Research Lab., Schenectady, N. Y.
CREEP OF NICKEL AT INTERMEDIATE TEMPERATURES. R. W. Guard. Aug. 1955. 17p. Contract AF33(616)-2120. (AD-71571).

The creep properties of high-purity nickel (99.95% Ni) wires have been determined in the temperature range 375 to 500°C at stresses of 10,000 to 25,000 psi. These data have been analyzed by examining the effects of temperature, stress and strain on the strain rate. The temperature dependence of the rate can be expressed by an activation energy process having ΔH equal to 54,500. The shapes of the curves and the stress dependence of the rate suggest a formal theory of creep based on a balance between strengthening and softening factors. Such a theory could relate the properties of the material to the structural changes occurring in creep. (auth)

5667 RM-1476(RAND)
Rand Corp., Santa Monica, Calif.
A PROPOSED MECHANISM OF FATIGUE FAILURE. F. R. Shanley. Apr. 11, 1955. 20p.

Reversed slip is assumed to occur on a single plane, either from the beginning of repeated loading, or after an initial period of slip on different planes. Such slip requires unbonding of the atoms which emerge at the surface of the material. It is assumed that a portion of these atoms do not regain their original bond when the slip is reversed. This results in progressive unbonding along the slip plane. The proposed mechanism is shown to be in agreement with observed facts and is used as a basis for deriving various well-known equations for the $\sigma-N$ diagram. The mechanism and equations are used to interpret and explain such phenomena as the endurance limit, effects of mean stress, variable amplitude loading, stress-concentration, elevated temperature, corrosion, and surface treatment. (auth)

5668 TML-29
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
THE OXIDATION OF TITANIUM AND TITANIUM ALLOYS. D. W. Stough, F. W. Fink, and R. S. Peoples. Jan. 30, 1956. 62p. Contract AF18(600)-1375.

The oxidation of Ti and its alloys is reviewed. The scaling behavior in pure oxygen was found to vary according to three different rate laws in the approximate temperature ranges of 80 to 570°F, 570 to 1100°F, and 1100 to 1800°F, respectively. The rate of oxidation increases with temperature; scaling becomes an important consideration in the fabrication and life of Ti materials above 1100°F. None of the commercial alloys were reported to have good oxidation resistance above 1100°F. However, experimental alloys with Al, Si, W, Nb, Mo, and Ta were found to scale less rapidly than the unalloyed metal between 1200 and 1800°F. Alloys with Cr, Mn, Fe, and V generally were noted to scale faster than unalloyed Ti. (auth)

5669 TML-30
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio
FLOW PROPERTIES, DEFORMATION TEXTURES, AND SLIP SYSTEMS OF TITANIUM AND TITANIUM ALLOYS. F. C. Holden, D. N. Williams, W. E. Riley, and R. I. Jaffee. Jan. 31, 1956. 96p. Contract AF18(600)-1375.

The methods used to predict formability are described, and the flow properties for a number of experimental Ti alloys are tabulated and compared. Most of the data presented are for high-purity experimental alloys; flow properties for the commercial alloys are not available. Alpha alloys generally have higher uniform elongation than β alloys, and the uniform elongation of $\alpha-\beta$ alloys decreases with increasing β content. The effects of strain transformation, temperature, and H_2 content on flow properties are also discussed. The deformation mechanisms of alpha Ti at several temperatures are described, and the types of deformation textures developed by Ti are illustrated. (auth)

5670 TML-31
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
WELDING OF TITANIUM AND TITANIUM ALLOYS. G. E. Faulkner, W. J. Lewis, M. L. Kohn, and P. J. Rieppel. Feb. 7, 1956. 82p. Contract AF18(600)-1375.

A summary of the information in published literature and in Government and industrial research reports on the welding of titanium and its alloys is reported. It includes a discussion of welding procedures and methods of evaluating mechanical properties in welded joints. A section also is included on the mechanical properties of welded joints and how these properties are affected by alloying elements. (auth)

5671 TML-34
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
ANTIGALLING COATINGS AND LUBRICANTS FOR TITANIUM. E. L. White, P. D. Miller, and R. S. Peoples. Feb. 24, 1956. 53p. Contract AF18(600)-1375.

A survey of methods of reducing the galling type of wear of Ti and its alloys indicates that bare Ti and its alloys cannot be satisfactorily lubricated. The most acceptable lubricants thus far tested are of the fluorocarbon type. However, satisfactory wear performance, for many operations, can be obtained by the use of coatings of various kinds on Ti surfaces plus suitable lubricants. The wear resistance of the metal can be improved by oxide, nitride, and carbide case hardening and coatings. The poor wear characteristics of Ti can be circumvented by metallic coatings of Cr, Al, Cu, Ni, and other metals. Also, chemical conversion coatings, such as fluoride-phosphate coatings, phosphate coatings, and anodized coatings, reduce the wear and improve the lubrication of the metal. The wear characteristics of the presently available commercial alloys are quite similar to the metal itself and generally can be improved by the same techniques. (auth)

5672 WADC-TR-53-50(Pt.II)
Battelle Memorial Inst., Columbus, Ohio.
BEHAVIOR OF BRITTLE-STATE MATERIALS. Omar K. Salmassy, Edward G. Bodine, Winston H. Duckworth, and George K. Manning. June 1955. 164p. Project title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(038)-8682.

The fracture of brittle-state materials, primarily brittle ceramics, was studied. The principles for the selection, evaluation, and design of brittle materials from a statistical or probability viewpoint were set forth. The distribution curve of fracture stresses was found to give an adequate description of the strength of a brittle body under a given set of conditions. The mean fracture stress of a brittle body was found to be inadequate for the design of a brittle structure. The factors influencing the fracture of brittle ceramic materials were studied, including the effects of size, stress state, strain rate and delayed fracture, temperature, and flaws. The entire distribution curve of fracture stresses was indicated to be a function of the size and stress state of a brittle body. All the materials investigated, glass, porcelain, nickel-bonded titanium carbide, plaster of Paris, and embrittled steel showed the same qualitative effect of size and stress state. Weibull's statistical theory of strength predicted the effect of size, and the effects observed in the simple stress states of tension, bending, and torsion. Weibull's theory was not

adequate, however, for predicting the effects of combined stresses. The research indicated that static-fatigue data will require statistical analysis before they are safe for use in the design of certain ceramics under sustained loads. The materials studied exhibited an increase in strength with increasing strain rate. (auth)

5673 WADC-TR-53-182(Pt.II)
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
INVESTIGATION OF THE METALLURGICAL CHARACTERISTICS OF THE 36% ALUMINUM TITANIUM-BASE ALLOY. [Period covered] June 1953 to August 1954. J. B. McAndrew and D. J. McPherson. Jan. 1955. 65p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-196.

An assessment of the potentialities of 36% Al Ti-base alloys as aircraft structural materials is reported. Experimental data are given concerning the stress-rupture strength of Ti–36% Al at 800, 900, 950 and 1000°C; the room temperature and 1000°C tensile strength of Ti–36% Al; the impact strength of the same alloy at room temperature, 700, and 1000°C; and the oxidation resistance of this material at 1000 and 1200°C in still air environments. Less extensive data are reported concerning the effects of ternary additions, especially Nb and Ta, on the properties of the base alloy. Casting and powder metallurgy techniques applicable to this type of alloy are discussed. Hammer forging was successfully used to prepare material of wrought structure. It is concluded that additional research effort directed toward the possibility of modifying the properties of Ti–36% Al to meet the particular demands of various high temperature applications is warranted. Immediate application on other than an experimental basis undoubtedly would be restricted by insufficient development of fabrication processes. (auth)

5674 WADC-TR-53-230(Pt.II)
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
STUDY OF EFFECTS OF ALLOYING ELEMENTS ON THE WELDABILITY OF TITANIUM SHEET. [Period covered] August 1953 to August 1954. Herbert M. Meyer. June 1955. 315p. Project title: METALLIC MATERIALS. Task title: TITANIUM METALS AND ALLOYS. Contract AF33(616)-206.

It is concluded that interstitial elements in titanium alloy weldments are harmful under some conditions. Where possible, limits of utility are described. Under some conditions the interstitial elements carbon, nitrogen and oxygen show promise as strengtheners at not too high a cost of ductility, and may be valuable as inexpensive alloying additions already present in the titanium sponge. Heat treatments that will restore ductility after embrittlement by the welding cycle are described in terms of the individual phase relationships. (auth)

5675 WADC-TR-54-206
Michigan. Univ., Ann Arbor.
THERMAL-SHOCK INVESTIGATION. T. A. Hunter, L. L. Thomas, and A. R. Bobrowsky. Sept. 1954. 103p. Contract AF 33(038)-21254. (AD-51570).

A program of investigation has been undertaken to evaluate the resistance of various material to thermal shocking. A preliminary analysis of thermal-shock damage has been carried out on a theoretical basis. The results of this theoretical work indicate that the scope of the problem is so wide that purely analytical methods must be supplemented by experimental data. An experimental program has therefore been set up to test fourteen materials for their relative resistance to severe repeated thermal shock from the temperature range of 1600 to 2000°F. A suitable apparatus has been constructed and a standard specimen shape has been devised which give reasonable reproducibility of results. Excursions into the subjects of previous specimen history, mechanical fatigue, and thermal wiggling have also been made. (auth)

5676 WADC-TR-54-303
Battelle Memorial Inst., Columbus, Ohio.
RELATIONSHIP BETWEEN ISOTHERMAL AND ANISOTHERMAL–NUCLEATION CHARACTERISTICS OF AUSTENITE DECOMPOSITION PRODUCTS. C. R. Simcoe, A. R. Elsea, and G. K. Manning. Sept. 1954. 34p. Project title: METALLIC MATERIALS. Task title: SUPPORTING RESEARCH ON HIGH-STRENGTH STEEL FOR AERONAUTICAL APPLICATIONS. (AD-55199).

A study of the additivity of fractional nucleation times indicates that the temperature ranges of additivity are not the same for all steel compositions. Knowing the temperature ranges of additivity, the time and temperature for transformation to start for various cooling rates was calculated by using the Scheil hypothesis. The calculated values compared fairly well with experimental values determined from interrupted end-quench tests for SAE 4340, 2.5 wt.% Cr–0.35 wt.% C, and 0.80 wt.% Cr–0.75 wt.% C steels. A 1.0 wt.% Cr–0.50 wt.% C steel showed greater hardenability than the calculations would predict. The greater hardenability of the 1.0 wt.% Cr–0.50 wt.% C steel may result from a lack of complete additivity of fractional nucleation times over the bainite-formation temperature range. There is some evidence that the lower hardenability in the boron steel may result from the effect of internal stress on the nucleation rate of this steel. (auth)

5677 WADC-TR-54-320
Case Inst. of Tech., Cleveland.
DELAYED FAILURE AND HYDROGEN EMBRITTLEMENT IN STEEL. R. P. Frohmberg, W. J. Barnett, and A. R. Troiano. June 1954. 60p. Contract AF33(038)-22371. (AD-38142).

The phenomenon of delayed failure in steel has been correlated with the presence of electrolytically introduced hydrogen. Delayed failure may occur over a wide range of relatively low applied stresses and this stress range is dependent upon strength level, notch acuity and aging time after the introduction of hydrogen. The observed reductions in ductility are a function of both the depth of hydrogen penetration and the degree or severity of hydrogen embrittlement. The effects of aging with and without load have demonstrated the necessity of exceeding some minimum critical stress in the presence of hydrogen to embrittle steel. A bainitic structure was shown to behave in a fashion similar to that of tempered martensite, except that the overall embrittlement appeared less severe. (auth)

5678 WADC-TR-54-568
Bjorksten Research Labs., Inc., Madison, Wis.
RESEARCH ON TREATED MAGNESIUM SURFACES. [Period covered] March 1953 to October 1954. Stanley E. Rohowetz. July 1955. 186p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: ELECTRODEPOSITION AND ELECTROCHEMICAL TREATMENTS. Contract AF33(616)-2032.

Research for the development of an accelerated performance test for treated magnesium alloys included the following corrosion resistance tests: pH increase in 1.0N KCl; open circuit potential comparisons; short circuit current comparisons; hydrogen evolution rates in 1.0N KCl (gasometric method). The following tests of adhesion of zinc chromate primer (MIL-P-6889A) to the treated surfaces were also included: adhesion in shear (wrought alloy specimens); adhesion in tension (cast alloy specimens); impact, ultrasonic vibratory, and pressure-sensitive tape

tests (qualitative). The gasometric method was the most promising test for evaluation of corrosion resistance. It was critical in its evaluation of unprimed treated magnesium alloys within five hours and of primed specimens in seven days. The Dow #7 acid chromate treatment gave lower hydrogen evolution rates than the Dow #12 alkaline anodic treatment on all alloys tested. In the shear and tension adhesion tests, the Dow #7 gave higher adhesion to the primer than the Dow #12. Corrosion rates for unprimed treated specimens obtained from several weathering tests did not correlate with the rates from accelerated laboratory tests. The corrosion rate of the Dow #7 was nonlinear and increased after a given time due to depletion of the protective chrominum ions. Painted specimen rates, however, were in agreement with the accelerated test rates and showed the superiority of the Dow #7 over the Dow #12. The corrosion resistance of primed-lacquered specimens far exceeded the difference in resistance afforded by the various treatments. (auth)

5679 WADC-TR-55-325(Pt. 1)
Syracuse Univ., N. Y.
THE EFFECTS OF INTERSTITIAL CONTAMINANTS ON THE NOTCH-TENSILE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. PART I. IODIDE AND SPONGE TITANIUM. [Period covered] November 15, 1953 to May 15, 1955. Eugene P. Klier and Neil Feola. Mar. 1956. 104p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2281.

The notch-tensile properties of sponge titanium contaminated with oxygen, nitrogen and carbon were determined. The merit rating of sponge titanium in the notch-tensile test does not conform to that in the impact test. In the small (0.3 inch diameter) specimen the levels of interstitial contamination in unalloyed titanium which may be expected to give a notch-strength ratio of unity at −65°F are as follows: (Ti-base O_2 = 0.035%); carbon ~ 0.4%; oxygen ~ 0.13%; and nitrogen ~ 0.25%. Limited data for impact tension and sustained load tests are presented and discussed. (auth)

5680 WADC-TR-55-470(Pt. I)
Michigan. Univ., Ann Arbor.
AN INVESTIGATION OF INTERGRANULAR OXIDATION IN STAINLESS STEELS AND HIGH-NICKEL ALLOYS. [Period covered] March 1954 to February 1955. Clarence A. Siebert, Maurice J. Sinnott, Lynn H. DeSmyter, and Robert E. Keith. June 1955. 108p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-353.

Chromel alloys ASM, ARM, and D, type 310 stainless steels, and Inconel were subjected to oxidation in the unstressed condition in moving dry air, having a dew-point less than minus 40°F, at temperatures of 1600, 1700, 1800, 1900, and 2000°F. The duration of the tests was 100 hours for the majority of the tests. The oxidized samples were mounted, polished metallographically, and measured for intergranular penetration, recording the numbers of fissures and their depths. In general, the intergranular oxidation increased with time and temperature. Increasing the testing time from 100 to 500 hours caused a marked increase in intergranular penetration in some alloys. It was found that the increased humidity of the ambient air had in general a small effect on the intergranular penetrations. Visual examination and magnetic tests were performed on the oxidized specimens and the oxide itself. No correlation between these observations and oxidation characteristics could be found. X-ray-diffraction studies were performed on a few of the oxides resulting from the oxidation procedures. Electron diffraction examination of the subsurface structure was performed on type 310 stainless steels oxidized in the unstressed condition. It was found that the oxidation products in the subsurface region were substantially the same as the surface oxides as determined by x-ray-diffraction techniques. (auth)

5681 WADC-TR-56-26(Pt. 1)
Battelle Memorial Inst., Columbus, Ohio.
AN INVESTIGATION OF THE INTERCHANGE OF TENSILE CREEP FOR COMPRESSIVE CREEP. PART 1. TYPES 2024-T4 AND 1100-0 ALUMINUM. [Period covered] December 15, 1954 to December 15, 1955. O. K. Salmassy, R. J. MacDonald, R. L. Carlson, and G. K. Manning. Mar. 1956. 63p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN AND EVALUATION DATA FOR STRUCTURAL METALS. Contract AF33(616)-2738.

Aluminum 1100-0 and aluminum alloy 2024-T4 were subjected to tension- and compression-creep testing at varying stress levels and temperatures. Creep data were compared to establish whether significant differences existed between tension and compression behavior. Room-temperature and elevated-temperature static properties of each material were obtained. Metallographic and hardness studies were used to supplement the results of creep and static tests. Test equipment and test techniques were developed which permitted creep measurements approaching 10 microinches per inch in sensitivity and ±25 microinch accuracy. Data obtained on 2024-T4 and 1100-0 aluminum in all instances indicated greater creep resistance in compression. Differences in tension- and compression-creep strain decreased with increasing temperatures. Results indicated that a reversal in the interchange of 2024-T4 may take place between 375°F and 450°F and that interchange may be a temperature-dependent phenomenon. (auth)

5682 WAL-370/18-8
Utah. Univ., Salt Lake City.
HIGH PRESSURE OXIDATION OF METALS—NIOBIUM IN OXYGEN. Interim Technical Report No. 9. Donald W. Bridges and W. Martin Fassell, Jr. Mar. 25, 1955. 30p. Contract DA-04-495-ORD-237. (AD-66553).

Niobium was found to oxidize linearly in oxygen from 400 – 800°C. at oxygen pressures from 14.7 to 605 psia. Wide variations in the oxidation rates were observed with increase of pressure. Theoretical considerations indicate an equilibrium adsorption process occurs prior to the rate determining step. It was necessary to include a term for the interaction between the adsorbed oxygen molecules to adequately interpret results above 650°C. Orientation of the metal surface apparently influences the interaction energy. The enthalpy of activation was found to be 9000 to 10,000 calories (500 to 800°C.). The enthalpy and entropy of adsorption were found to be −48,550 cal./mole and −52.6 e.u. (550 to 650°C.). The molar interaction energy was found to vary from 8,300 calories (500°C) to 11,900 calories (800°C). (auth)

5683 AEC-tr-2505
MECHANICAL RESISTANCE OF ALUMINA COATINGS AND ITS INFLUENCE ON THE SURFACE TENSION OF MOLTEN METAL. Albert Portevin and Paul Bastien. Translated by K. Bevis from Compt. rend. 202, 1072-4 (1936). 3p.

5684 AERE-Lib/Trans-593
THEORY OF SURFACE TENSION OF BINARY ALLOYS. A. E. Glauberman. Translated by R. C. Murray from Zhur. Fiz. Khim. 28, 1263-7(1954). 8p.

5685 AERE-Lib/Trans-631
THE EFFECT OF AN ELECTRON BOMBARDMENT ON THE PLASTICITY OF METAL CRYSTALS. Erich Schmid

and Karl Lintner. Translated by R. S. Forsyth from Z. Metallkunde 46, 71-6(1955). 12p.

5686 AERE-Lib/Trans-642
THE EFFECT OF INTERSTITIAL ATOMS ON THE SELF DIFFUSION OF A METAL. M. A. Krivoglaz and A. A. Smirnov. Translated by R. C. Murray from Doklady Akad. Nauk S.S.S.R. 96, 495-8(1954). 7p.

A mathematical analysis is given to explain the effect of small additions of C in the self-diffusion of iron in the lattice of γ iron. (F.S.)

5687 AERE-Lib/Trans-643
PARAMAGNETIC RELAXATION IN METALS. S. V. Vosonskii and S. G. Salikov. Translated by R. C. Rurray from Doklady Akad. Nauk S.S.S.R. 96, 717-19(1954). 4p.

5688 AERE-Lib/Trans-697
ON THE TEMPERATURE DEPENDENCE OF THE SURFACE TENSION OF METALS. S. N. Zadumkin. Translated by T. Turton from Doklady Akad. Nauk S.S.S.R. 101, 507-9(1955). 5p.

5689 RAE-Lib/Trans-498
MICROSPECTROGRAPHIC ANALYSIS OF METALS AND ALLOYS. (L'analyse Microspectragraphiques des Métaux et Alliages). J. Descamps. Translated by B. E. C. Jenkins from Recherche aéronaut., No. 32, 39-49(1953). 22p. (AD-70414).

A survey of the various microspectrographic techniques in use shows that this is a rapid and simple method of analysis in the scientific control of alloys and in the development of new alloys. The precision is not as high as desired but as a qualitative or semi-quantitative method results are adequate in dealing with research problems on segregation, inclusions, and grain boundaries. (F.S.)

5690 RAE-Trans-495
THE STUDY, BY ELECTRON DIFFRACTION, OF CERTAIN REACTIONS AND SURFACE STRUCTURES IN THE CASE OF METALS. (METHOD OF GRINDING IN VACUO). (Étude, par Diffraction Électronique, de Certaines Réactions et Structures Superficielles dans le Case des Métaux. (Methode de Meulage dans le Vide)). Robert Courtel. Translated by W. F. Fielding from Metaux and Corrosion 25, 117-25; 145-55; 188-99(1950). 47p. (AD-70413).

The apparatus used for this work and the precautions taken in preventing oil contamination from the driving motor are described. Some of the physico-chemical properties which arise from newly-formed metallic surfaces are described, and the mechanism of the Bielby layer and further lines of study suggested by the preliminary experiments are described. The preferential orientations caused by grinding and an experimental and theoretical study of the surface temperature reached during grinding are described. The general character of the oxidation of simple metals during grinding and the presence of "oxidation thresholds" for such alloys as Ni – Cr are discussed. The formation of the type C sesquioxide of cerium and the determination of its crystalline form are described. (auth)

5691
ANODIC FILM GROWTH ON HAFNIUM IN NITRIC ACID. R. D. Misch and E. S. Fisher (Argonne National Lab., Lemont, Ill.). J. Electrochem. Soc. 103, 153-6(1956) Mar.

In 70% HNO_3 at room temperature, an anodic film developed uniformly over single Hf crystals with a thickness dependent upon the metal crystal orientation. At 0.025 ma/cm^2 the cell voltage did not exceed 1.5 v; at 1.5 ma/cm^2 the cell voltage rose to 185 v and the film was broken down by sparking. At 90°C and 0.025 ma/cm^2, the oxide developed discontinuously over Hf crystals with the formation of wedge-like patches. This discontinuous growth was attributed to nucleation at metal surface imperfections. An orientation effect in the electropolishing of Hf was also noted. (auth)

5692
PLATING THICKNESS BY THE ATTENUATION OF CHARACTERISTIC X-RAYS. Paul D. Zemany and Herman A. Liebhafsky (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 103, 157-9(1956) Mar.

The attenuation by iron foil of a characteristic line for Ag or Zr as substrate has been measured in a spectrograph. Results show that the exponential absorption law is followed closely. (auth)

5693
INVESTIGATION OF CERTAIN PHYSICAL PROCESSES OCCURRING ON METAL SURFACES AT HIGH TEMPERATURE. I. "NATURAL ROUGHNESS" OF POLYCRYSTAL SURFACE. Ya. E. Geguzin and N. N. Ovchazenko (Khar'kov State Univ.). Izvest Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk 108-18(1956) Jan. (In Russian).

Polycrystalline crystals with part of their surfaces exposed in a vacuum, and possessing excess of surface energy can induce certain processes in a crystal sublayer which do not extend to the internal surfaces of the sample. The polished microsection of a polycrystalline sample as a rule does not coincide with the natural facet of the crystal and at high temperatures tends to establish its natural grain structure. An attempt is made to investigate the processes occurring on the surface and subsurface layers of metals at high temperatures. (R.V.J.)

5694
STRENGTHENING OF NICKEL SOLID SOLUTIONS AT HIGH TEMPERATURES. I. I. Kornilov (Inst. of Metallurgy). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk 119-25(1956) Jan. (In Russian).

Mechanical properties of pure metals (hardness and temporary or lasting strength) are determined by the bond strength between atoms in the crystalline lattice of metals. The strength of pure metals is increased with the concentration and number of chemical elements dissolved, and the increased strength is retained at high temperatures. Nickel alloys of Ni–Fe, Ni–Cr, Ni–Cr–Ti, and Ni–Cr–W–Al–Ti were studied at room temperature and in the temperature range up to 900°. It was shown that the greater the number of different atoms dissolved, in various degrees of saturation, the higher was the temperature in which the alloy retained its increased strength. (R.V.J.)

5695
DETERMINATION OF LIMITED SOLUBILITY SURFACES OF A TRIPLE SYSTEM BY THE MICROSOLIDIFICATION METHOD. V. M. Glazov, M. V. Zakharov, and M. V. Stepanova. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk 162-4(1956) Jan. (In Russian).

The copper–chromium–zirconium system is used to show the applicability of microsolidification method for triple systems, and to establish the dependence of microsolidification on the composition during the transition of one phase into another. Electrolytic copper and Cu–Cr (6.93% Cr) and Cu–Zr (11.1% Zr) alloys were used as initial materials. The experiments showed the high solubility of Cu–Cr–Zr triple systems and revealed that an additional solubility of Cu and Cr can be achieved by addition of Zr, while an increase of Cr into Zr does not produce the same effect. The results showed the method to be practical. Diagrams and tabulations are given for Cu and Zr solubility in copper at temperatures up to 1000°C. (R.V.J.)

5696
CONTROL HEAT TO DROP TITANIUM FORMING COSTS. A. E. Leach and H. M. Lundstrom (Bell Aircraft Corp., Buffalo). Iron Age 177, No. 6, 98-101(1956) Feb. 9.

Springback in Ti may be controlled by establishing the yield strength and carefully controlling the forming temperature. (D.E.B.)

5697

COLD WELD NICKEL ALLOYS FOR ATOM PLANT USE. E. Nutter (Elano Corp., Xenia, Ohio). Iron Age 177, No. 7, 111-13(1956) Feb. 16.

A cold-metal arc welding technique for Ni alloys is described. (D.E.B.)

5698

QUADRUPLE INTERSYSTEMS OF FLUORINE AND SODIUM, POTASSIUM, CALCIUM AND BARIUM CHLORIDES AS FLUX BASE FOR REMELTING OF SECONDARY LIGHT METALS. G. A. Bukhalova and A. G. Bergman. Zhur. Priklad. Khim. 28, 1266-74(1955) Dec. (In Russian).

Investigations of the applicability of these systems as a flux for remelting and refining secondary aluminum were made. The results proved that the $Na_2Cl_2-K_2Cl_2-CaF_2$ and $Na_2Cl_2-K_2Cl_2-BaF_2$ systems permit the selection of suitable combinations as the flux in various conditions and uses. On the basis of the available data and the study of $Na_2Cl_2-K_2Cl_2-CaF_2$ and $Na_2Cl_2-K_2Cl_2-BaF_2$ systems, a topological analysis was made of the Na, K, Ca// F, Cl, Na, K, Ba// F, Cl quadruple intersystems. Diagrams and tabulations are given. (R.V.J.)

5699

POLYMORPHISM OF IRON AT HIGH PRESSURE. Dennison Bancroft, Eric L. Peterson, and Stanley Minshall (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 27, 291-8 (1956) Mar.

Propagation of compressive waves generated by high explosive in Armco iron may, under certain conditions, occur with three stable shocks, which are characterized by abrupt and possibly quasi-discontinuous change of pressure. The characteristics of these have been investigated experimentally and found to be consistent with the hypothesis of a polymorphic transition in iron at about 0.13 megabar. The same phenomenon has been observed in mild steel. (auth)

5700

PREFERRED ORIENTATIONS IN ROLLED AND ANNEALED TITANIUM. J. H. Keeler and A. H. Geisler (General Electric Co., Schenectady, N. Y.). J. Metals 8, 80-90(1956) Feb.

Preferred orientations in rolled and annealed titanium sheets were determined by the Geiger counter spectrometer x-ray diffraction technique. Five annealing textures dependent upon the temperature range of annealing were found and in order of increasing annealing temperature are: deformationlike texture; rotated α-recrystallization texture; retained α-recrystallization texture on annealing at lower temperatures of the β-region, transformation texture based on recrystallized α and predicted by the Burgers' relationship; and β-cube texture. These results are examined in terms of current theories of recrystallization textures. (auth)

5701

THERMODYNAMIC PROPERTIES OF SOLID Fe–Au ALLOYS. L. L. Seigle (Sylvania Electric Products Inc., Bayside, N. Y.). J. Metals 8, 91-7(1956) Feb.

Free energies, heats, and entropies of mixing of solid Fe–Au alloys have been measured by the galvanic cell method between 800 and 900°C. A positive deviation from Raoult's law and a large excess entropy of mixing were observed, both attributable to lattice distortion caused by the disparity in component atom sizes. Since the terminal solid solutions are not regular, thermodynamic properties computed from the location of the miscibility gap do not agree well with measured quantities. The electromotive force data suggest some changes in the existing Fe–Au phase diagram. (auth)

5702

SYSTEM ZIRCONIUM–NITROGEN. R. F. Domagala, D. J. McPherson, and M. Hansen (Armour Research Foundation, Chicago). J. Metals 8, 98-105(1956) Feb.

Phase relationships in the Zr–N system were investigated at N_2 concentrations up to 13.3 wt.%. The peritectic formation of α and β solid solutions was noted. The maximum solubility of N_2 is 0.8 wt.% in beta Zr and 4.8 wt.% in alpha Zr. (C.W.H.)

5703

HOT-ROLLED TEXTURES OF TITANIUM ALLOYS. C. J. McHargue (Oak Ridge National Lab., Tenn.) and J. R. Holland and J. P. Hammond (Univ. of Kentucky, Lexington). J. Metals 8, 113-14(1956) Feb.

The cold-rolled and hot-rolled (at 1050, 1450, and 1600°F) textures of Ti–Al, Ti–Zr, and Ti–Ta alloys are reported. (C.W.H.)

5704

MECHANISM OF PLASTIC FLOW IN TITANIUM AT LOW AND HIGH TEMPERATURES. F. D. Rosi, F. C. Perkins, and L. L. Seigle (Sylvania Electric Products Inc., Bayside, N. Y.). J. Metals 8, 115-22(1956) Feb.

The mechanism of plastic flow in coarse grained specimens of both sponge and iodide Ti at low (–196°C) and high (500° and 800°C) temperatures was investigated. Deformation by slip occurs predominantly on a $\{10\bar{1}0\}$ plane and in a $<11\bar{2}0>$ direction over this entire temperature range, and secondary slip on $\{10\bar{1}1\}$ planes becomes more prevalent with increasing temperature. The crystallographic habit of the predominant twin type is temperature-dependent, and deformation by twinning increases as the temperature of testing is lowered. Kink bands were not observed at –196°C and rarely at the high temperatures. (auth)

5705

ALLOTROPIC TRANSFORMATIONS IN TITANIUM, ZIRCONIUM, AND URANIUM ALLOYS. Austin E. Dwight (Argonne National Lab., Lemont, Ill.). J. Metals 8, 162-3 (1956) Feb.

The equation, $\ln x_\alpha/x_\gamma = -Q_B/RT$, (where x_α and x_γ are atomic percents of solute x which can be held in solution at equilibrium at the α and γ phases, respectively, at temperature T (°K), and Q_B is a thermodynamic index quantity) has been successfully applied to allotropic transformations in Ti-, Zr-, and U-base alloys. (C.W.H.)

5706

MECHANISM OF GRAIN BOUNDARY SLIDING. H. C. Chang and Nicholas J. Grant (Massachusetts Inst. of Tech., Cambridge). J. Metals 8, 169-70(1956) Feb.

Experimental results indicate that grain boundary sliding in Al–Zn alloys takes place by a bulk shear process. (C.W.H.)

5707

SEARCH FOR OXIDATION-RESISTANT ALLOYS OF MOLYBDENUM. G. W. P. Rengstorff (Battelle Memorial Inst., Columbus, Ohio). J. Metals 8, 171-6(1956) Feb.

The oxidation resistance of molybdenum binary alloys at elevated temperatures was investigated. No high oxidation-resistant alloys were found. (C.W.H.)

5708

TRANSFORMATION OF THE TiO PHASE. Chih-Chung Wang and Nicholas J. Grant (Massachusetts Inst. of Tech., Cambridge). J. Metals 8, 184-5(1956) Feb.

X-ray diffraction studies of the $Ti-TiO_2$ systems indicate that the TiO phase undegoes transformation from an NaCl-type structure to a low-symmetry structure at temperatures ~925°C. No apparent transformation has been found from metallographic observations and hardness and density measurements. (C.W.H.)

5709

INTERNAL FRICTION IN ZIRCONIUM. W. J. Bratina and W. C. Winegard (Univ. of Toronto, Canada). J. Metals 8, 186-9(1956) Feb.

Internal friction characteristics and temperature dependence of the torsion modulus for iodide Zr containing 2.4 at.% Hf were investigated, using a low frequency pendulum technique. The internal friction curve consists of a background which increases as the temperature increases, a maximum at 860°C apparently due to the allotropic transformation, a maximum due to grain boundary relaxation with an associated heat of activation of 58,000 cal/mole, and an anomaly below 350°C which may be associated with a precipitation phenomenon. Oxygen in small amounts reduces the grain boundary maximum substantially. The variation of the torsion modulus at 20°C was found to be 3450 kg/mm^2. (auth)

5710

TENSILE CREEP OF HIGH PURITY ALUMINUM. R. W. Guard and W. R. Hibbard, Jr. (General Electric Co., Schenectady, N. Y.). J. Metals 8, 195-9(1956) Feb.

The tensile properties of high-purity Al (~ 99.994 wt.%) have been determined at constant stress over a wide range of temperatures and stresses. (auth)

5711

DIFFUSION IN LIQUID LEAD. S. J. Rothman and L. D. Hall (Stanford Univ., Calif.). J. Metals 8, 199-203(1956) Feb.

The diffusion of the radioactive tracers RaD (lead) and RaE (bismuth) in liquid Pb has been studied in the temperature range 606 to 930°K. The heats of activation have been calculated as 4450 and 4070 cal/g atom, respectively. The results have been compared with the predictions of several theories of diffusion, with varying degrees of agreement. (auth)

5712

TITANIUM-RICH CORNER OF THE Ti–Al–V SYSTEM. J. J. Rausch and F. A. Crossley (Armour Research Foundation, Chicago) and H. D. Kessler (Titanium Metals Corp. of America, Henderson, Nevada). J. Metals 8, 211-14(1956) Feb.

The Ti rich corner of the system Ti–Al–V has been studied to determine the phase relationships in the temperature interval 600 to 1200°C. Metallographic examination of long time isothermally annealed specimens was the principal method of investigation. (auth)

5713

EFFECT OF COOLING RATE ON HARDNESS OF COMMERCIAL TITANIUM ALLOYS. Howard Martens (California Inst. of Tech., Pasadena). J. Metals 8, 288(1956) Feb.

5714

CORROSION RESISTANCE AND MECHANICAL PROPERTIES OF Cr-Ni-Mn STAINLESS STEELS. R. A. Lula and W. G. Renshaw (Allegheny Ludlum Steel Corp., Brackenridge, Penna.). Metal Progr. 69, No. 2, 73-7(1956) Feb.

The corrosion resistance and mechanical properties of Cr–Mn–Ni stainless steels (AISI 201 and 202) were found to be excellent for many structural applications in corrosive environments. In some cases an alloy with more Cr and Ni is necessary to resist severe applications in chemical industry. (auth)

5715

HYDROGEN CONTAMINATION OF TITANIUM MINIMIZED BY MODIFIED DESCALING BATH. H. L. Alexander, H. Farrell, and Q. D. Wheatley (E. I. du Pont de Nemours & Co., Inc., Niagara Falls, N. Y.). Metal Progr. 69, No. 2, 78-80(1956) Feb.

Saturation of NaH baths with TiO_2 minimizes H pick-up during descaling of Ti. It was found that coarser grades of TiO_2 should be used and added slowly to avoid excessive foaming and gas evolution. (auth)

5716

HOW STATISTICAL TECHNIQUES SOLVE METALWORKING PROBLEMS. PART I. Chester R. Smith (Mallory-Sharon Titanium Corp., Niles, Ohio). Metal Progr. 69, No. 2, 81-6 (1956) Feb.

Two examples are presented of the statistical techniques which illustrate the best methods for processing Ti at a minimum expense. (auth)

5717

FACTORS INFLUENCING THE NOTCH FATIGUE STRENGTHENING OF N-155 ALLOY AT ELEVATED TEMPERATURES. W. S. Hyler and W. F. Simmons (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Soc. Mech. Engrs. 78, 339-48 (1956) Feb.

Data are given to illustrate the effect of stress raisers on the elevated-temperature fatigue behavior of N-155 alloy. These data were obtained on specimens notched with V-grooves having various root radii and various notch severities. The experimental program was in direct-stress fatigue, and covered a range of alternating stress to mean stress from A = 0.0 to A = ∞ at temperatures of 1200 to 1500°F. The effect of surface finish also was studied to a limited extent. A metallographic study of fractured surfaces was carried out. (auth)

5718

FACTORS INFLUENCING THE NOTCH-RUPTURE STRENGTH OF HEAT-RESISTANT ALLOYS AT ELEVATED TEMPERATURES. R. L. Carlson, R. J. MacDonald, and W. F. Simmons (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Soc. Mech. Engrs. 78, 349-58(1956) Feb.

Stress-rupture tests were conducted on notched and unnotched or plain bars of S-816, Inconel "X" Type 550, and Waspaloy alloys at test temperatures ranging from 1200 to 1600°F. The notched specimens had 50% 60-deg, V-notches with the root radii ranging from 0.005 to 0.100 in. In some tests, as many as three notches of different root radii were used. The test results indicated that S-816 alloy was notch-strengthened by all of the notches used in the temperature range from 1350 to 1600°F. Inconel "X" Type 550 was always notch-strengthened by all of the notches only at the test temperature of 1600°F. Waspaloy was always notch-strengthened by all notches only at the temperature of 1500°F. Both Inconel "X" Type 550 and Waspaloy could be notch-strengthened for some test conditions (notch sharpness and time) at temperatures below 1600 and 1500°F, respectively. The factors investigated are notch geometry, notched and unnotched ductility, the modes of deformation and fracture, metallurgical changes, and surface condition. The influence of some of these factors can vary considerably from alloy to alloy. It does not appear possible, therefore, to evaluate completely the notch and unnotched stress-rupture behavior of a given alloy by any simple method. Rather, an evaluation should be based upon the combined consideration of those factors that are influential in each individual case. (auth)

5719

ZIRCONIUM-FABRICATION TECHNIQUES AND ALLOY DEVELOPMENT. C. E. Lacy and J. H. Keeler (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Soc. Mech. Engrs. 78, 427-33(1956) Feb.

The fabrication techniques by which zirconium and its alloys have been successfully made into various product forms are described. The neutron-absorption characteristics, mechanical properties, and corrosion resistance of zirconium and some zirconium alloys are discussed. (auth)

5720

WELDING OF HIGH-TEMPERATURE HIGH-PRESSURE PIPING WITH CHROME-MOLY ELECTRODES. Lloyd C.

Nesbitt (Metal and Thermit Corp., New York). Welding J. (N. J.) 35, 129-35(1956) Feb.

Chrome-moly E-XX15 low carbon, low hydrogen electrodes have been developed to produce satisfactory welds on ferric chromium–molybdenum steel. (auth)

5721

THE CARBON-DIOXIDE-SHIELDED METAL-ARC WELDING PROCESS. R. J. Keller and J. Koss (A. O. Smith Corp., Milwaukee). Welding J. (N. Y.) 35, 145-51(1956) Feb.

The carbon dioxide shielded metal-arc welding process has a high potential for welding cost reduction and produces excellent weld metal quality. It is an automatic welding process with a visible arc, and does not require flux for arc protection, thus eliminating slag removal problems after welding. (J.E.D.)

5722

TENSILE-IMPACT PROPERTIES OF COMMERCIALLY PURE TITANIUM AT VARIOUS TEMPERATURES. O. H. Henry and B. Z. Hyatt (Polytechnic Inst. of Brooklyn). Welding J. (N. Y.) 35, 99s-101s(1956) Feb.

Welded and non-welded specimens of pure Ti were tested at -65, 70, and 600°F to determine tension-impact energy, elongation and reduction in cross-sectional area. (auth)

5723

DEFORMATION CHARACTERISTICS OF HAFNIUM. D. S. Eppelsheimer and D. S. Gould (Missouri School of Mines and Metallurgy, Rolla). Nature 177, 241-2(1956) Feb. 4.

5724

CREEP AND FRACTURE OF METALS AT HIGH TEMPERATURES. PROCEEDINGS OF A SYMPOSIUM HELD AT THE NATIONAL PHYSICAL LABORATORY MAY 31–JUNE 2, 1954. London, Her Majesty's Stationery Office, 1956. 420p. $6.75(OTS).

Papers were presented on deformation processes in simple materials, creep resistance of complex materials, theory of fracture, and investigations on tertiary creep and fracture. 22 papers. (C.W.H.)

5725

A FURTHER STUDY OF THE OXIDATION OF TITANIUM AND ITS ALLOYS AT HIGH TEMPERATURES. A. E. Jenkins (New South Wales Univ. of Tech., Kensington). J. Inst. Metals 84, 1-9(1955) Sept.

Investigations were continued on the oxidation of Ti and binary alloys of Ti with Sn, Zr, Fe, Al, or W in the temperature range 650 to 950°C and at O_2 pressures ranging from 700 to 40 mm Hg. (C.W.H.)

5726

TEXTURES IN FACE-CENTERED CUBIC METALS AND ALLOYS. R. E. Smallman (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inst. Metals 84, 10-18(1955) Sept.

From quantitatively determined (111) pole figures, it is shown that the rolling texture in face-centered cubic metals is approximately (123) [$1\bar{2}1$]. The orientation normally associated with face-centered cubic metals, (110) [$\bar{1}12$], occurs in substitutional alloys such as Cu–Zn, Al–Cu, Au–Cu and Ni–Mo alloys. The (110) [$\bar{1}12$] texture can be obtained in any face-centered cubic metal, provided that the necessary second element is added in solution in sufficient concentration. The effectiveness of a given solute varies when alloyed with different solvents, and the range of solute concentration required to produce a complete (110) [$\bar{1}12$] texture is also different for each solute element in any given solvent. The quantitative pole figures show that the transition from the (123) [$1\bar{2}1$] to the (110) [$\bar{1}12$] type of texture is gradual, extending over a fairly large range of composition. The results are interpreted in terms of solute "atmosphere" locking, and several predictions of characteristic slip behavior are made; in particular, it is suggested that slip-plane hardenability and "overshoot" are both concentration-dependent and temperature-dependent. On annealing, the (123) [$1\bar{2}1$] texture gives the cube orientation, the intensity of which decreases with alloying addition; the decrease is particularly marked at small solute concentrations. (auth)

5727

METALLOGRAPHIC STUDY OF SODIUM, POTASSIUM, RUBIDIUM, AND CESIUM AFTER COOLING TO 1.2°K. Charles S. Barrett (Univ. of Chicago). J. Inst. Metals 84, 43-6(1955) Oct.

Large unrestrained grains of sodium (99.94% pure), free from oxide, were found to undergo a partial martensitic transformation when cooled below 36.2 ± 2°K. Smaller grains with unoxidized surfaces usually began to transform at about 31°K., and those with oxidized surfaces at somewhat lower temperatures. The amount transformed increased to the order of 1 to 10% on further cooling to 1.2°K. No trace of a similar spontaneous transformation was found in 99.4% potassium, 99.9% rubidium, or 98.7% cesium. (auth)

5728

THE CONSTITUTION OF THE TITANIUM–OXYGEN ALLOYS IN THE RANGE 0–35 WEIGHT PER CENT OXYGEN. T. H. Schofield and A. E. Bacon (National Physical Lab., Teddington, England). J. Inst. Metals 84, 47-53(1955) Oct.

Constitution diagrams were redetermined for Ti–O systems containing up to 35 wt.% oxygen. Agreement with previously published work was obtained. (auth)

5729

TENSILE PROPERTIES OF SOME TITANIUM TERNARY SOLID SOLUTIONS AND DUPLEX ALLOYS UP TO 600°C. J. W. Suiter (Univ. of Melbourne, Australia). J. Inst. Metals 84, 81-3(1955) Dec.

The tensile properties at elevated temperatures of three classes of ternary solid solutions in α-titanium and of three duplex alloys have been measured. All the solid-solution alloys exhibited the same general behavior, in that the addition of a third element to a solid solution in α-titanium gave approximately the same degree of hardening as that caused by the addition of that element alone to Ti. Thus, ternary solid solutions suffered the same rapid decrease in strength above 500°C. as was found previously in binary solid solutions. Compared with the strongest solid-solution alloys, the duplex alloys studied showed no substantial increase in strength at 600°C. (auth)

5730

ON THE RECRYSTALLIZATION OF COLD-ROLLED COMMERCIALLY PURE TITANIUM. Ichiji Obinata (Tohoku Univ., Sendai, Japan) and Keizo Nishimura (Furukawa Electric Co., Nikko, Japan). J. Inst. Metals 84, 97-101(1956) Jan.

The recrystallization of cold-rolled commercially pure Ti has been studied. Two types of recrystallization are found to take place simultaneously; one not involving nucleation and the other proceeding by the ordinary nucleation-and-growth mechanism. A notable feature is the lack of uniformity, both in the progress of recrystallization and in the grain-size immediately after recrystallization is complete. This is attributed to non-uniformity in twinning during earlier cold work. The recrystallization temperature of titanium has been determined as a function of cold reduction. A recystallization diagram is proposed based on determinations of the grain-size after annealing as a function of rolling reduction and time of annealing. It has been established that the twin bands appearing in grains lightly deformed as a result of cold rolling exhibit a definite

directionality. This is explained on crystallographic grounds. (auth)

5731
PLASTIC LAPS FOR THE PREPARATION OF SPECIMENS FOR METALLOGRAPHIC EXAMINATION. V. J. Haddrell, E. C. Sykes, and B. W. Mott (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inst. Metals 84, 112-14(1956) Jan.

Experiments have shown that polythene-bonded laps provide a useful means of preparing specimens for metallographic examination, particularly in the final stages, without the need for the reactivation and trueing necessary when wax or lead laps are used. Polythese discs covered with Terylene fabric are very suitable for attack-polishing and provide a simple alternative to electrolytic polishing. Experimental laps of both types can be made for particular applications by using standard metallographic equipment and basic materials of little cost. Practical details are given. (auth)

Refer also to abstracts 5806, 5886, and 6021.

PHYSICS

5732 AD-72508
Little (Arthur D.) Inc., Cambridge, Mass.
LIQUID HYDROGEN — FIELD USE AND NEW LIQUEFACTION SYSTEMS. Alexis Pastuhov and C. Lincoln Jewett. [1955]. 24p.

A review was made of the properties as well as the methods of liquefaction, shipment, and storage of H. Descriptions are given of: minimum explosion temperatures for various H—O mixtures; ortho-para conversion of stored liquid H; and the Joule-Thomson (high pressure system) and the Collins He cryostat systems of liquefying H. Although the Collins He cryostat unit is primarily designed to supply liquid He, an auxiliary liquefying system can liquefy other gases, such as H, Ne, and N. A prototype He refrigeration unit was developed for the liquefaction and/or the recondensing of gas from boiling H. In addition, several He refrigerated, liquid H transport vehicles were constructed. The liquid H container (Dewar) on these values is a vacuum-jacketed tank with a capacity of about 530 gal. The small rate of heat leaks through the vacuum insulation and the radiation shield plus the rate of heat generation by ortho-para conversion is offset by the use of the He refrigeration system. The methods used in the transfer of liquid H from a storage Dewar to another component are described. Several advantages, including safety, are presented for using He refrigerated systems in the field. (auth)

5733 AD-79339
Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
VAPOR DEPOSITED COATINGS. Final Report. L. McD. Schetky, H. S. Spacil, and J. Wulff. Aug. 1, 1955. 66p. DA Project No. 593-08-024 and DIC Project No. 6950. Contract DA-19-020-ORD-837.

In one phase of the present work, the process of vapor deposition of molybdenum was improved by the use of helium as a carrier gas for molybdenum halide vapor, and by deposition of molybdenum on the interior of graphite tubing. A test consisting of transverse compression of a ring of vapor-deposited molybdenum was developed to determine the mechanical properties of the metal. Using this test it was found that molybdenum produced by the improved deposition process showed appreciable ductility (corresponding to several percent elongation) in the as-deposited condition. Molybdenum tubes made by this process were used to make molybdenum-lined steel cylinders. A satisfactory method of measuring the composition of a gas stream containing corrosive metal halide vapors was developed. The mechanism of the hydrogen reduction occurring during vapor deposition was treated theoretically, leading to useful, general results. A study was made of the deleterious effects of dissolved oxygen on the mechanical properties of molybdenum metal. Solid molybdenum can be purified of dissolved oxygen by heating in a good vacuum (10^{-6} mm). For 0.010 in. diameter wire this purification is finished within 30 minutes. Above 1900°C, purification is complete enough to result in a level of ductility equal to that of the as-received metal. From this and other data, a tentative Mo—O_2 phase diagram was constructed. (auth)

5734 AERE-C/R-1892
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ELECTRODEPOSITION OF RUTHENIUM. A. C. Littlejohn. Mar. 1, 1956. 6p.

Experiments were carried out to determine the conditions necessary to produce deposits of Ru on Al and Cu that would be suitable for use in neutron bombardment experiments. No success was achieved using Al cathodes but reasonable deposits were obtained on Cu from solutions of Ru nitroso trichloride in dilute HCl. Conditions producing the best quality deposits are listed. (auth)

5735 AERE-M/R-1846
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SURFACE ENERGIES OF SOLID OXIDES AND CARBIDES. D. T. Livey and P. Murray. Jan. 24, 1956. 29p.

The surface energies of the alkali halides are considered in relation to lattice energy, molar volume, and heat of formation. The conclusions derived are applied to a consideration of the surface energies of oxides which range in value from 250 ergs/cm^2 for PbO to >1420 ergs/cm^2 for BeO. Agreement is generally good between the predicted value from those relations and the available data. Exceptions arise in those oxides which either contain heavy metal ions such as Cd^{++} and Pb^{++} or cations of high polarizing power such as B^{3+} and Si^{4+} leading to polarization effects and surface screening of the cations and the production of low energy surfaces. The surface energies of the refractory monocarbides as determined from wetting experiments are shown to vary linearly with their heats of formation. (auth)

5736 AWRE-O-11/53
Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
SINGLE AND REPETITIVE SPARK LIGHT SOURCES. H. Goodfellow. Nov. 20, 1953. 30p.

The characteristics of a spark light source necessary for the recording of high definition shadow and schlieren shock wave photographs are discussed. Some development work on both single and multiple flash spark light sources is described and constructional details are given of a single flash light source of about half a microsecond effective duration and a six-flash unit with a controllable maximum repetition frequency of about 500,000 sparks per second. (auth)

5737 BM-RI-5182
Bureau of Mines.
A QUALITATIVE EVALUATION OF SEVERAL ELECTROLYTES FOR ELECTROREFINING BISMUTH. P. M. Gruzensky and W. J. Crawford. Jan. 1955. 34p.

Several experiments have been carried out in efforts to evaluate qualitatively a variety of electrolytes for

refining bismuth. Most extensive work was done with the basic tartrate, hydrochloric acid, and hydrofluosilicic acid electrolytes. Deposits that are smooth and adherent can be obtained from these three electrolytes if low cathode current densities are employed. All three electrolytes were effective in purifying crude bismuth considerably, with additional purification indicated in each instance by a reelectrolysis step. With the basic tartrate electrolyte best results were obtained when the electrolyte was at 40°C. and contained at least 100 grams of bismuth per liter. An apparent disadvantage was depletion of bismuth from this electrolyte, causing the deposits to become spongy and nonadherent. The hydrochloric acid electrolyte had the greatest tendency to yield rough, dendritic deposits. Best deposits were obtained at cathode-current densities below 2 amperes per square decimeter. A small amount of glycerin helped to produce a smoother deposit, and adding sulfuric acid or methyl sulfuric acid retarded the deposition of impurities. Very good results were obtained in electrowinning bismuth from a bismuth trichloride-hydrochloric acid electrolyte. Smooth and adherent deposits were obtained from a hydrofluosilicic acid electrolyte, with very good refining as regards lead and silver impurities; however, higher reagent costs and slow decomposition of the electrolyte have discouraged its use. (auth)

5738 NACA-TN-3657

Lewis Flight Propulsion Lab., Cleveland.

FRICTION STUDIES OF GRAPHITE AND MIXTURES OF GRAPHITE WITH SEVERAL METALLIC OXIDES AND SALTS AT TEMPERATURES TO 1000°F. Marshall B. Peterson and Robert L. Johnson. Dec. 14, 1955. 16p.

Powdered graphite lubricated metal surfaces at temperatures in the vicinity of 1000°F when a metallic oxide film could be formed and maintained. Mixtures of soft metallic oxides such as lead oxide or cadmium oxide with graphite were effective lubricants at all temperatures from room temperature to 1000°F unless a chemical reaction occurred between the graphite and the oxide. (auth)

5739 NP-5875

Brown Univ., Providence. Barus Research Lab. [of Physics].

EFFECTS OF RADIATION QUENCHING, ION-BOMBARDMENT AND ANNEALING ON CATALYTIC ACTIVITY OF PURE NICKEL AND PLATINUM SURFACES. Interim Technical Report No. 1 [for] July 1, 1955—January 1, 1956. H. E. Farnsworth and R. F. Woodcock. Jan. 20, 1956. 10p. Project title: EFFECTS OF GAS CONTAMINATION AND STRUCTURE DEFECTS ON SURFACE CATALYSIS. Contract DA-19-020-ORD-3647.

5740 NP-5879

Columbia Univ., New York. Columbia Radiation Lab.

RESEARCH EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Final Quarterly Progress Report [for] September 1, 1955 through December 15, 1955. P. Kusch. Dec. 15, 1955. 42p. DA Project No. 3-99-10-022. Contract DA-36-039-SC-42519. (CU-13-55-SC-42519-Phys.)

Calculations for the purpose of correlating the reflected power in a magnetron with the position of a perturber have been completed and experimentally verified. A theoretical evaluation of the hyperfine structure of the J = K = 6 inversion transition of $N^{14}H_3$ was made and an approximate fitting with experimental data undertaken. A theoretical study of Cherenkov radiation from a modulated electron beam has been developed where plasma oscillations within the beam are considered. Modulation by means other than a bunching cavity has been studied. F-band absorption in KH was measured at three different temperatures. (D.E.B.)

5741 NP-5988

Pennsylvania State Univ., University Park.

RESEARCH AND DEVELOPMENT ON THE THERMODYNAMICS OF SIMPLE GASES ADSORBED ON SOLIDS. Technical Report Covering Period February 1, 1956 to April 30, 1956. J. G. Aston. Consists of a Preliminary Version of a Thesis: ADSORPTION OF RARE GASES ON GRAPHITE. Jerome Greyson. Apr. 30, 1956. 59p. DA Project 5B99-01-004. Contract DA-36-061-ORD-509.

The details of construction of an adiabatic calorimeter are described. Using the calorimeter for the measurement of the heat of adsorption of neon and helium on a highly graphitized carbon black, it was shown that the adsorbent is energetically homogeneous. An interpretation of the experimental results plus the results of similar investigations with argon and krypton led to the conclusion that an adsorbed film behaves analogously to a compressed liquid. (auth)

5742 NRL-4451

Naval Research Lab., Washington, D. C.

THE SHIELDED TRANSMISSION LINE METHOD OF GENERATING STANDARD FIELDS. W. E. Garner and H. E. Dinger. Oct. 19, 1954. 16p.

One of the methods extensively used for the calibration of equipments using loop antennas is the shielded transmission-line method, wherein a wire is erected between two end walls of a shielded room. One end of the conductor is connected to an end wall through a resistance equal to the characteristic impedance of the line, and the output of a signal generator is connected between the other end of the line and the wall. Thus, the wire and shielded room form a shielded transmission line terminated in its characteristic impedance. The loop antenna to be calibrated is placed below and in the vertical plane of the wire. The true field strength at the loop, produced by a known current in the line, can be calculated by applying the Biot-Savart law to the line and all of the images of the line in the ceiling, floor, and walls. When only a few images are considered, as is common practice, it was found that the error in the calculated field can be 20% or more. For some typical installations a 5% error was obtained when as many as 96 images were considered. (auth)

5743 NRL-Memo-561

Naval Research Lab., Washington, D. C.

THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS. Progress Report No. 15 [for] August 1—October 31, 1955. B. E. Walker, C. T. Ewing, and R. R. Miller. Jan. 1956. 7p.

Heat content and heat capacity measurements have been made on salt "E" from 30 to 900°C. Measurements in the liquid range were at 500, 600, 700, 800, and 900°C. Results on heat capacity over this range varied from 0.45 to 0.41 cal/g 1°C. Preliminary measurements on heat content of salt "D" have been made. (For preceding period see NRL-Memo-516.) (auth)

5744 AERE-Lib/Trans-663

THEORETICAL POSSIBILITY OF SEPARATING BEAMS OF CHARGED PARTICLES WITH DIFFERENT POLARISATIONS IN A MAGNETIC FIELD. V. V. Vladimirskii. Translated by S. Botcharskii [Botcharsky] from Doklady Akad. Nauk S.S.S.R. 102, 1099-1100(1955). 3p.

5745 AERE-Lib/Trans-678

THE ELECTRICAL RESISTANCE AND PLASTIC DEFORMATION OF METALS. Hendrik Gerard van Bueren. Translated by F. Hudswell from Z. Metallkunde 46, 272-82(1955). 23p.

A theoretical study of the formation of lattice defects by plastic deformation, properties of individual lattice defects, comparison of experiment and theory, and the relaxation of the conductivity on heating are discussed. (tr-auth)

5746 AERE-Lib/Trans-701
ON THE THEORY OF THE POLARISATION VOLTAGE IN THE ELECTROLYSIS OF FUSED SALTS. Paul Drossbach. Translated by F. Hudswell from Z. Elektrochem. 58, 67-76 (1954). 32p.

A number of boundary value problems, important to both the theory of single potentials and to the theory of the method used for measuring the polarization voltage was studied. (auth)

5747
WATER DROP ION ADSORPTION IN THE AIR FLOW. Ts. G. Breĭdo. Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz. 87-91(1956) Jan. (In Russian).

An attempt is made to expand Ya. I. Frenkel's drop charge diffusion theory by introducing a wind factor which accounts for the velocity of the air flowing over a drop. The consideration of wind factor gives the theoretical value of the drop charge corresponding to experimental data previously obtained by the author. (tr-auth)

5748
HEAT CONDUCTIVITY AND VISCOSITY OF LIQUID He^3. Bipin Kumar Agarwal (Univ. of Allahabad). Progr. Theoret. Phys. (Japan) 14, 493-4(1955) Nov.

Through the use of a solid model, equations for heat conductivity and viscosity in He^3 are derived which are in agreement with results obtained from the Fermi-Dirac gas model. Heat conductivity varies inversely as T, and viscosity varies with T^2. (D.E.B.)

5749
POLARIZED LUMINESCENCE IN CUBIC CRYSTALS. P. P. Feofilov. Uspekhi Fiz. Nauk 58, 69-84(1956) Jan. (In Russian).

Detailed studies were made of luminescent center orientation on the symmetry axis of fluoride, lithium fluoride, and sodium fluoride cubic crystals. The nature of elementary polarization of Eu ions polarized luminescence, and anisotropic chemical processes in cubic crystals are investigated. The results indicate that the basic distinguishing features of polarized radiation in cubic crystals are determined by the orientation of luminescent centers along the cubic crystal symmetry axis. This fact offers new explanations for the structural details of luminescent centers and helps to solve some problems in the chemistry of mixed crystals. (R.V.J.)

5750
THE ISOTOPE EFFECT OF A DIRECT ELECTRIC CURRENT THROUGH LIQUID AND SOLID METALS. E. Haeffner, Th. Sjöborg, and S. Lindhe (AB Atomenergi, Stockholm, Sweden). Z. Naturforsch. 11a, 71-5(1956) Jan. (In English).

The isotope separation effect of a direct electric current in a liquid metal is demonstrated by passing a current through mercury, which is enclosed in a capillary tube. The second part of the paper deals with an attempt of establishing an isotope effect when a direct current is passed through an uranium wire. (auth)

5751
THE ISOTOPIC EFFECT IN THE ELECTROLYTIC DIFFUSION OF LITHIUM IONS IN MOLTEN LITHIUM NITRATE. Arnold Lundén, Ernst Ulrich Monse, and Nils G. Sjöberg. Z. Naturforsch. 11a, 75-9(1956) Jan. (In German).

AEROSOLS

5752 AEC-tr-2408
SIMPLE METHOD FOR DETERMINING THE PARTICLE SIZE OF CHLORIDE AEROSOL. I. Sano, Y. Fujitani, and K. Sugiyama. Translated from J. Chem. Soc. Japan Pure Chem. Sect. 76, 466-8(1955). 7p.

A simplified method of determining the viscosity of aerosols is described. Chloride particles are deposited on gelatine film, sensitized with a substance capable of forming precipitates with chloride (Hg_2, SiF_6, $HgNO_3$, and HgCl). The precipitate particles formed after the reaction are observed under a microscope. The applicability of this method in determining particle size is reported. (R.V.J.)

5753
A MEASUREMENT OF ATMOSPHERIC RADIOACTIVITY AT WELLINGTON. L. B. Crosthwait (Victoria Univ. Coll., Wellington, New Zealand). New Zealand J. Sci. Tech. B37, 382-4(1955) Nov.

A filter paper method of collecting atmospheric radioactivity is described. The mean radon concentration found by this method was 34×10^{-18} curies per cc. (auth)

5754
AN INVESTIGATION OF THE VARIATION OF THE ATMOSPHERIC RADIOACTIVITY AT WELLINGTON FROM 5 MAY TO 18 JULY 1955. N. G. Chapman (New Zealand Defence Science Corps.) and R. W. Humphrey (Victoria Univ. Coll., Wellington). New Zealand J. Sci. Tech. B37, 396-406(1955) Nov.

An account is given of the variations of the radon content in the atmosphere as measured at Victoria University College, Wellington, during the period 5 May to 18 July 1955. The collection apparatus was situated 9 m above the local ground level and 130 m above sea level. The filter paper collection method was used, a description of the apparatus used and a discussion of the efficiency of this method being included. In this discussion a lower limit for the average value of the radon content in the period of 37×10^{-18} curies/cc is obtained. A diurnal variation in the radon content was found which showed principal and secondary minima, the principal at about 12 to 14 hr N.Z.M.T. and the secondary at 20 to 21 hr N.Z.M.T. The effect of wind speed on the radioactive content is shown and some indications obtained regarding the influences of wind direction, barometric pressure, and rainfall. From the results, approximate upper limits for the amount of fission product activity present in relation to the amount of natural radioactivity in the atmosphere at this locality have been obtained. (auth)

ASTROPHYSICS

5755
HYPOTHESIS FOR THE ORIGIN OF THE MAGNETIC FIELDS AND ANGULAR ROTATIONS OF STARS AND PLANETS. Winston H. Bostick (Univ. of California, Berkeley). Phys. Rev. 100, 1007-8(1955) Nov. 15.

From theoretical considerations it is to be expected that gravitational contraction of ionized material across a magnetic field will produce an enhancement of the magnetic field and a rotational angular momentum of the mass. This process may be associated with the magnetic fields and rotations of galaxies, stars, and planets, and may possibly play a role in an expanding universe. (auth)

COSMIC RADIATION

5756 AERE-Lib/Trans-536
ON THE CHERENKOV RADIATION OF COSMIC PARTICLES IN THE ATMOSPHERE. V. I. Gol'danskiĭ and G. B. Zhdanov. Translated by J. B. Sykes from Zhur. Eksptl.' i Teoret. Fiz. 26, 405-16(1954). 13p.

An estimate is made of the total production and height distribution of visible radiation due to Cherenkov radiation of cosmic particles in the atmosphere. The possibility of recording individual high-energy particles and extensive

atmospheric showers is considered, on the basis of observations of light pulses from such radiation. (auth)

5757

ON THE ACCELERATION OF COSMIC-RAY PARTICLES BY MAGNET-HYDRODYNAMIC WAVES. W. B. Thompson (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A233, 402-6(1955) Dec. 29.

The equations for the motion of charged particles through varying magnetic fields are derived. The application of these equations is shown to give a more satisfactory description of the observed cosmic particle acceleration than the theory of elastic collisions with magnetized clouds. (D.E.B.)

5758

HEAVY UNSTABLE PARTICLES. (HYPERONS AND K MESONS). A. O. Vaĭsenberg. Uspekhi Fiz. Nauk, 57, 631-89(1955) Dec. (In Russian). (cf. NSA 10-2101.).

A general review of up to date data on charged K mesons, charged $V^{\pm}$ particles, K meson and hyperon formations, and their interactions with nuclei are presented. (R.V.J.)

5759

THE EFFECT OF LUNAR-TIDAL OSCILLATION OF THE ATMOSPHERE ON THE INTENSITY OF THE HARD COMPONENT OF COSMIC RAYS. A. I. Kuz'min and G. V. Skripin (Yakutsk Branch of the Academy of Sciences of the U.S.S.R.). Soviet Phys. JETP 1, 556-7(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 608-9(1955) May. (In Russian).

It is shown that δI, the observed twelve hour variation in cosmic ray intensity, exhibits a sinusoidal variation with a period of 14.3 days. This is possible only when δI contains a component of period 12h 25m 14s, or half the linear period. (B.J.H.)

5760

VARIATION OF THE GLOBAL INTENSITY OF THE HARD COMPONENT OF COSMIC RAYS DURING THE PASSAGE OF AIR MASS FRONTS. D. D. Krasil'nikov (Yakutsk Branch of the Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 1, 557-60(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 610-13(1955) May. (In Russian).

The average hourly global intensity of the hard component of cosmic radiation was measured to an accuracy of several tenths of a percent. Weather conditions were also recorded. Intensity variations are plotted with the profiles of warm and cool air fronts. The results are analyzed in detail. (B.J.H.)

5761

THE CONTRIBUTION OF METEOROLOGICAL CHANGES IN THE EARTH'S ATMOSPHERE TO THE DIURNAL EFFECT IN COSMIC RAYS. A. I. Kuz'min (Yakutsk Branch of the Academy of Science, U.S.S.R.). Soviet Phys. JETP 1, 560-2(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 614-16(1955) May. (In Russian).

Accurate determinations were made, at a height of 100 meters, of the global intensity of the hard component of cosmic radiation. It was concluded that the diurnal variation of this intensity has a nonmeteorological origin and amounts to about 1%. (B.J.H.)

5762

MEASUREMENT OF THE ABSORPTION COEFFICIENT OF HIGH ENERGY NUCLEAR INTERACTING PARTICLES. K. P. Ryzhkova and L. I. Sarycheva (P. N. Lebedev Inst. of Physics). Soviet Phys. JETP 1, 572-4(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 618-19(1955) May. (In Russian).

Designs are shown for the large area detector used for the measurement of the absorption of high-energy particles. Pertinent data on all recorded cosmic showers are tabulated, and the absolute energies of the shower producing particles were calculated. (B.J.H.)

5763

PRIMARY COSMIC-RAY ALPHA PARTICLES AND PROTONS AT $\lambda = 55°N$. L. R. Davis, H. M. Caulk, and C. Y. Johnson (U. S. Naval Research Lab., Washington, D. C.). Phys. Rev. 101, 800-6(1956) Jan. 15.

The intensities of the primary cosmic-ray alpha particles and protons at geomagnetic latitude 55°N are determined from measurements of the ionization and range of the charged cosmic-ray particles observed at atmospheric depths of 8 g/cm^2 and deeper. The measurements were made with a balloon-borne Geiger-proportional counter telescope which contained absorbers of mercury or lead. Showers of particles in the telescope were detected by out of line counters and eliminated. The particles having residual ranges between 1.5 g/cm^2 are shown to be secondary electrons and secondary protons. The penetrating particles having range greater than 43 g/cm^2 divide into singly and doubly charged particles. Extension of the penetrating particle intensity curves to zero depth yields values for the primary intensities of 0.19 (cm^2 sec sterad)$^{-1}$ for protons and 0.032 (cm^2 sec sterad)$^{-1}$ for alpha particles. The alpha particles are absorbed exponentially in the atmosphere, and the slope of the absorption curve yields the value 35 ± 7 g/cm^2 for their mean free path in air. Data obtained by removing the absorbers in flight indicate that the net results are free of shower effects. Other systematic uncertainties in the values of the primary intensities are estimated to be ±10%, which is larger than the statistical uncertainties. (auth)

5764

CALCULATIONS ON THE CASCADE THEORY OF SHOWERS. S. K. Chakrabarty and M. R. Gupta (Bengal Engineering Coll., Howrah, India). Phys. Rev. 101, 813-19(1956) Jan. 15.

The solution of the cascade equations, obtained previously by Bhabha and Chakrabarty, is rearranged in a form suitable for numerical calculations. Although the solution is still in the form of an infinite series, the first term alone gives practically the entire contribution to the number of particles in a shower for all values of the energy of the shower particles. The results are compared with the values given previously by Bhabha and Chakrabarty and also by Snyder. The defects in the analysis of Snyder are discussed. Values of N(E,t), the total number of particles in a shower having energies greater than E, are obtained for different values of E, t, and E_0. By the evaluation of a single integral it is now possible to obtain the values of N(E,t) for any value of E in the entire range $(0,E_0)$, and also the nature of the energy spectrum of the shower electrons at different depths. Asymptotic values to which P(E,t) and N(E,t) merge, when E tends to zero and infinity, are derived from the general expression. It is shown that the values of $N_0(t) + N_2(t)$, derived previously by Bhabha and Chakrabarty, is a fair approximation to the value of N(E,t) if we take $E = 2mc^2$. (auth)

5765

EFFECTS OF A RING CURRENT ON COSMIC RADIATION. Ernest C. Ray (State Univ. of Iowa, Iowa City). Phys. Rev. 101, 1142-8(1956) Feb. 1.

A theoretical analysis of the effect of an equatorial ring current on the latitude variation of the primary cosmic radiation has been carried out. It has been found that a ring current of the size suggested by Schmidt should lead to observable effects on the latitude variation. In particular, if a ring current of radius equal to 7.5 earth radii and current strength sufficient to produce a field of 100γ at the earth's equator exists, then the knee in the latitude variation is a feature of the rigidity cut-off curve rather than of the primary spectrum. The primary spectrum obtained with the use of geomagnetic theory which includes a ring current is satis-

factorily fitted with a function of the form $J = 0.29\ E^{-0.9}$ $(cm^2\ sec\ sterad)^{-1}$, where E is the total energy of a primary particle. Certain features of time variations of the cosmic-ray intensity apparently disagree with the theory. (auth)

5766

SCINTILLATION SPECTROMETER STUDY OF COSMIC RADIATION AT GREAT DEPTHS. S. Standil and R. W. Pringle (Univ. of Manitoba, Winnipeg, Canada). Phys. Rev. 101, 1395-6(1956) Feb. 15.

A scintillation spectrometer has been used to observe cosmic-ray events at depths down to 10,000 feet in an oil well. The observed intensity-depth relationship can be explained in terms of the μ-meson component and associated showers. The shower to μ-meson ratio increases by a factor of 4 in going from sea level to a depth of 1000 meters water equivalent. (auth)

5767

SOLAR ORIGIN OF COSMIC-RAY TIME VARIATIONS. P. Morrison (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 101, 1397-1404(1956) Feb. 15.

The sun is known to be responsible during at least some solar flares for sharp increases in the cosmic-ray intensity on earth. In contrast to the flare pulses, the other principal changes in cosmic-ray intensity are all smaller in amplitude, less steep in energy dependence (extending perhaps to 30 Bev/c), much slower in time scale, and very much more isotropic (worldwide). These latter changes are not correlated sharply with any conspicuous solar event. A common cause for all of the nonflare cosmic-ray changes is here proposed: time (and energy) modulation of the incoming cosmic-ray beam by the random diffusion of the particles through turbulent clouds of magnetized plasma emitted from the sun. The sporadic cosmic-ray storm decreases (Forbush events) occur when the earth is immersed in a strong fresh cloud following a solar flare. The eleven-year variations in intensity and low-energy spectrum arise from the combined effect of much weaker and more diffuse clouds which travel across the solar system to the region of the outer planets. The recurrent 27-day effects depend on the presence near the earth of a region of longer diffusion mean free path, which punches a channel into the pre-existing clouds. The origin of the clouds in active centers and the channels in magnetic monopole regions of the sun is discussed, and parameters obtained which describe the clouds, and their motions, adequate to produce the observed effects and quantitatively, astrophysically plausible. The small but complex diurnal cosmic-ray variations are not discussed in detail, but appear to fit in naturally. The observed variation of all these effects throughout one solar cycle agrees with the picture presented. (auth)

5768

INFLUENCE OF THE EARTH'S MAGNETIC FIELD ON AIR SHOWERS. R. J. Norman (Univ. of Melbourne, Australia). Phys. Rev. 101, 1405-6(1956) Feb. 15.

Cocconi has estimated that the deflection of air shower particles in the earth's magnetic field should produce some ellipticity of shower structure, with the major axis in the E-W direction. Experimental evidence is advanced to show that the variation in shower structure at sea level is less than 4%, which compares favorably with Cocconi's theoretical value of ~2% and proves that, at low altitudes, the displacement of particles from the shower axis produced by the earth's magnetic field is negligible in comparison with Coulomb scattering. (auth)

5769

COSMIC RAY PRODUCED BERYLLIUM ISOTOPES IN RAIN WATER. P. S. Goel, S. Jha, D. Lal, P. Radhakrishna and Rama (Tata Inst. of Fundamental Research, Bombay, India). Nuclear Phys. 1, 196-201(1956).

The two known radioactive isotopes of beryllium (Be^7 and Be^{10}) are produced in the atmosphere in nuclear disintegrations initiated by cosmic radiation. The long lived Be^{10} (half life 2.7 million years) is difficult to detect and has not yet been isolated. The short lived isotope Be^7 (half life 53 days) is easily detected in rain water and should, therefore, be of interest in meteorological studies. The average concentration of Be^7 in 8 monsoon rains in Bombay amounted to 2400 atoms per cm^3 and is consistent with the production rates predicted by Peters. (auth)

Refer also to abstract 5859.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5770 NYO-6329

Pittsburgh. Univ.

SOME CRYSTALLOGRAPHIC CHARACTERISTICS OF ORDERED $MgCd_3$ IN RELATIONSHIP TO ITS ANOMALOUS THERMAL EQUILIBRATION AT LOW TEMPERATURES. Progress Report for October 1, 1955 to January 1, 1956. W. E. Wallace, R. S. Craig, and T. D. Brotherton. Jan. 1, 1956. 13p. Contract AT(30-1)-647.

Specific heat determinations of MgCd and $MgCd_3$ revealed ranges of temperature of slow thermal equilibration. The MgCd range is from 200 to 300°K and for $MgCd_3$ from 190 to 240°K and 280 to 375°K. The order-disorder Curie point for $MgCd_3$ is at 350°K. This behavior appears to be caused by the slowness with which the order parameter relaxes from one equilibrium value to another following a temperature change. It was suggested that the sluggish behavior was due to the disordering process. It is now suggested that the slow thermal equilibration in $MgCd_3$ above 280° is due to secondary crystallographic effects. This investigation shows that the axial ratio is frozen in below 280°K but varies with temperature at higher temperatures. (F.S.)

5771

ANOMALOUS ABSORPTION OF SLOW NEUTRONS AND X-RAYS IN NEARLY PERFECT SINGLE CRYSTALS. J. W. Knowles (Atomic Energy of Canada Ltd., Chalk River, Ont.). Acta Cryst. 9, 61-9(1956) Jan.

Two nearly perfect calcite crystals were set in the parallel arrangement of a two-crystal neutron spectrotrometer, and the γ rays from neutron capture by the calcium of the second crystal, which was 2 in. thick, were measured with a NaI scintillation detector. A maximum change in γ-ray intensity of 2.5 ± 0.6% occurred near the angle of Laue reflection. An application of the dynamical diffraction theory gave a "dispersion curve" variation with angle for the γ-ray intensity. This theory agreed quantitatively with the experimental observation. In a second experiment concerning a search for anomalous absorption of neutrons incident at the Bragg angle, the transmission of neutrons by a 2 mm. thick cadmium sulphate crystal was measured and compared with the transmission of x rays. The incident radiations (1.30 Å neutrons and 0.708 Å x rays) were selected by reflection from calcite crystals. When the 2 mm. crystal was set near the position of Laue reflection, the x ray transmission increased from 1.5×10^{-4} to 4.5×10^{-4}, but the neutron transmission decreased from 3.3×10^{-2} to 2.9×10^{-2}, this decrease being equal to the reflected intensity. Both observations may be explained by postulating a mosaic block size of 0.4 mm. in the cadmium sulphate crystal. (auth)

5772

A NEUTRON-DIFFRACTION STUDY OF SODIUM SESQUICARBONATE. G. E. Bacon and N. A. Curry (Atomic Energy Research Establishment, Harwell, Berks, England). Acta Cryst. 9, 82-5(1956) Jan.

Fourier projections, on the (010) plane, of the neutron

scattering density of $Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$ have been obtained from single-crystal intensity data at room temperature. The length of the O–H bonds in the water molecules is 1.01 ± 0.02 A, with the hydrogen atoms displaced slightly from the line of the O–O bonds, so as to make the H–O–H angle approximately tetrahedral. The contours of the hydrogen atom at the centre of symmetry are markedly anisotropic, being extended along the O–O bond, and they are discussed in relation to possible "half-hydrogen" positions on either side of the center. (auth)

5773

STRUCTURES OF THE COMPOUNDS Th_2Cu, $ThCu_2$, Th_2Zn, AND $ThHg_3$. N. C. Baenziger, R. E. Rundle, and A. I. Snow (Iowa State Coll., Ames). Acta Cryst. 9, 93-4(1956) Jan.

Available crystallographic data on compounds of Th with Zn, Cu, and Hg are given. The data were obtained from powder diagrams. (B.J.H.)

5774

OCCURRENCE OF CsCl-TYPE ORDERED STRUCTURES IN CERTAIN BINARY SYSTEMS OF TRANSITION ELEMENTS. Paul A. Beck, J. B. Darby, Jr., and O. P. Arora (Univ. of Illinois, Urbana). J. Metals 8, 148-9 (1956) Feb.

X-ray diffraction analyses of Fe–V alloys (45 to 55 at.% V) did not establish the occurrence of CsCl-type ordered structures. (C.W.H.)

5775

THE CRYSTAL STRUCTURES OF SOME THORIUM COMPOUNDS. J. R. Murray (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inst. Metals 84, 91-6(1955) Dec.

The crystal structures of four compounds in the Th–Al system, one in the Th–Ag system, and one in the Th–Au system have been determined. $ThAl_3$ has the hexagonal Ni_3Sn (DO_{19}) structure, a = 6·500, c = 4·626 A.; $ThAl_2$ crystallizes in the hexagonal AlB_2 (C32) structure, a = 4·388, c = 4·162 A.; Th_3Al is tetragonal and isostructural with U_3Si_2, spacegroup D^5_{4h}—P4/mbm, a = 8·125, c = 4·217 A. Th_2Al has the tetragonal $CuAl_2$ (C16) structure, a = 7·614, c = 5·857 A. It is isostructural with Th_2Ag, a = 7·56, c = 5·84 A., and Th_2Au, a = 7.42, c = 5.95 A. These structures are compared with those reported for $ThCu_2$, $ThNi_2$, and Th_2Cu. Tentative explanations for the observed interatomic distances and axial ratios for these Th–X compounds are suggested, based on the environment of the atoms, the difference between their atomic and ionic radii, and an increase in Th–X interaction with an increase in the electronegativity of X. (auth)

Refer also to abstracts 5690 and 6025.

ELECTRICAL DISCHARGE

5776 AECU-3250

RAND Corp., Santa Monica, Calif.

CALCULATION OF FIELDS ON PLASMA IONS BY COLLECTIVE COORDINATES. A. A. Broyles. Apr. 24, 1956. 33p. Contract AT(11-1)-135. (P-849-AEC). $6.30(ph OTS); $3.00(mf OTS).

The probability of finding a given electric field on an ion in a plasma is computed with the aid of collective coordinates. All the ions are assumed to have the same charge a and the free electrons are replaced by a rigid negative smear. The Jacobian of the transformation to collective coordinates is expanded in a series of Hermite polynomials and one of the higher terms is computed as an estimate of the error. This error calculation indicates that a lower limit in the temperature probably exists below which present methods may not be used. This lower limit depends upon the form of the short range potential that is chosen. A cutoff in space at a particle separation of r_c is employed in place of the cutoff in wave number at k_c. An average short range potential as a function of temperature appears. The values of the probability are shown to be surprisingly insensitive to the value of r_c at infinite temperature and to compare well with the Holtsmark distribution. They also compare well with the SRNN approximation described in a previous paper in the temperature range where comparison is possible. Numerical results using the SRNN approximation are presented for temperature too low for the method outlined here. (auth)

5777 AERE-GP/R-1855

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

COMPACT D.C. POWER SUPPLIES IN THE 100 KV REGION. H. C. Whitby. Feb. 7, 1956. 19p.

5778 UCRL-4695

California. Univ., Livermore. Radiation Lab.

EXPERIMENTAL STUDY OF IONIZED MATTER PROJECTED ACROSS A MAGNETIC FIELD. Winston H. Bostick. May 10, 1956. 32p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

A plasma gun has been developed which projects ionized matter (metallic and deuterium ions) at speeds up to 2×10^7 cm/sec. There is some evidence to support the hypothesis that the plasma projected by this gun comes off in an expanding torus which is shaped by its own magnetic field. When the plasma gun is fired into a d-c magnetic field, the plasma forms a compact geometrical configuration (a plasma-magnetic entity called a plasmoid) which proceeds across the magnetic field. Plasmoids appear to be plasma cylinders elongated in the direction of the magnetic field. Plasmoids possess a measurable magnetic moment, a measurable translation speed, a transverse electric field, and a measurable size. Plasmoids can interact with each other, seemingly by reflecting off one another. Their orbits can also be made to curve toward one another. Plasmoids can be made to spiral to a stop if projected into a gas at about 10^{-3} mm Hg pressure. Plasmoids can also be made to smash each other into fragments. There is some scant evidence to support the hypothesis that they undergo fission and possess spin. (auth)

5779

THE PLASMA CHARACTERISTICS OF A MERCURY LOW PRESSURE DISCHARGE. W. Heribert Schneider. Acta Phys. Austriaca 10, 54-65(1956) Jan. (In German).

The complete evaluation of the characteristics, which are obtained with a small probe device in a low-pressure mercury discharge for anode voltages from 30 to 150 volts, anode currents from 25 to 350 ma, and Hg temperatures from −20° to +34°C, showed that, besides the primary electron group, two electron groups with Maxwellian velocity distribution exist in all parts of the plasma container. In most cases a correspondence of the relationship in the anode-cathode volume of the cylindrical experimental arrangement with that in the outskirts of the discharge was confirmed. The dependence of the characteristic magnitude of the plasma on the limit parameters is discussed. (tr-auth)

5780

GLOW-TO-ARC TRANSITION. W. S. Boyle and F. E. Haworth (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 101, 935-8(1956) Feb. 1.

The conditions for the glow-to-arc transition at moderately high pressures (50 to 1300 mm Hg) have been studied experimentally. It is found that over the whole pressure range the transition is certain when the field at the cathode

reaches a critical value. This result is shown to be consistent with a field emission mechanism for the transition. Calculations of the critical field based on this process are found to be in good agreement with the fields which are determined experimentally. (auth)

5781

WAVES IN A HEAVY, VISCOUS, INCOMPRESSIBLE, ELECTRICALLY CONDUCTING FLUID OF VARIABLE DENSITY, IN THE PRESENCE OF A MAGNETIC FIELD. R. Hide (Atomic Energy Research Establishment, Berks, England). Proc. Roy. Soc. (London) A233, 376-96(1955) Dec. 29.

The equilibrium of a horizontal layer of a heavy incompressible fluid of variable density ρ_0 in the vertical direction is stable or unstable according as $d\rho_0/dz$ (z being the upward vertical) is everywhere negative or is anywhere positive. In the unstable case, the rate n at which the system departs from equilibrium depends on the total wave number k of the initial disturbance, and there is, in general, one mode characterized by n_m and k_m which grows more rapidly than any other. In the stable case, after an initial disturbance the equilibrium may be restored either periodically or aperiodically, depending on the value of k. The periodic type of motion gives rise to horizontally propagated 'gravity waves'. The influence of viscosity and hydromagnetic forces on the hydrodynamical motion produced by a small disturbance of the equilibrium situation is examined. The appropriate perturbation theory is developed initially for any density field $\rho_0(z)$ and kinematical viscosity $\nu(z)$ for a fluid of constant electrical conductivity σ e.m.u. and magnetic permeability κ in the presence of a uniform magnetic field of strength H_0 in the direction of gravity, acceleration g. The solution is expressed in the form of integrals, and is shown to be characterized by a variational principle. Based on the variational principle an approximate solution is obtained for the special case of a fluid of finite depth d stratified according to the law $\rho_0 = \rho_1 \exp(\beta z)$, and for which ν is constant. It is shown that if n and k are measured in suitable units, they are related by an equation involving three dimensionless parameters: $R = (\eta\pi s/2dV_A)$, $S = (\nu\pi s/2dV_A)$ and $B = (g\beta d^2/\pi^2 s^2 V^2{}_A)$, where $\eta = (4\pi\kappa\sigma)^{-1}$, $V^2{}_A = (kH_0^2/4\pi\rho_1)$, and s is an integer involved in the description of the velocity field. Explicit solutions may be obtained in three cases, namely, (a) $R \to \infty$, (b) $B = 0$, (c) $R = 0$. Only cases (b) and (c) are considered. (auth)

ELECTRONS

5782 AERE-GP/M-187

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FURTHER ELECTRON GUNS FOR USE IN METRE-WAVE HIGH POWER TRIODES. L. S. Holmes. Jan. 27, 1956. 19p.

A number of different gun configurations designed to be used in the Mk I and Mk II high-power grounded grid triode valves being developed at A.E.R.E. are described. A simplified gun using standard 4 mm. diameter rods for the grid and cathode beam forming elements has been evolved, and guns have been tested using flat channel, convex, concave, and double rod cathodes. The change of grid-cathode spacing and the resultant alteration in gun characteristics has been explored. (auth)

5783 NP-5989

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

QUARTERLY PROGRESS REPORT NO. 40 FOR PERIOD ENDING NOVEMBER 30, 1955. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Jan. 15, 1956. 169p.

DA Project 3-99-10-022. Contract DA-36-039-sc-42607.

Progress was reported on the statistical communication theory, microwave electronics, nuclear magnetic resonance hyperfine structure, and physical electronics. Brief mention was made of the work on sensory replacement, communications biophysics, microwave spectroscopy, and microwave gaseous discharges. (F.S.)

5784

ON EXPERIMENTAL PROOFS OF THE WAVE MECHANICAL THEORY OF FIELD ELECTRON EMISSION. R. Haefer. Acta Phys. Austriaca 10, 149-61(1956) Jan. (In German).

For an earlier experimental investigation on the proof of the wave mechanical tunnel effect theory of field emission, the difficulty was that the electric field vectors and the current density at the vertex of the electron-microscope image-forming cathode point could not be determined, so that the real forms of the vertices differ from any of the theoretical rotation hyperboloids. By use of a short method worked out by Drechsler and Henkel it is possible to calculate the field vectors and current density at the vertex of the point and thereby show how much the experimentally determined constants must be corrected. The correction factors obtained in this way are so measured that the validity of the earlier results obtained by consideration of the image potential is maintained. (tr-auth)

5785

POSITRON ELECTRON ANNIHILATION AND POSITRONIUM. II. G. M. Lewis (Glasgow Univ., Scotland). Atomics 7, 62-6(1956) Feb.

Some significant features of the annihilation process are indicated. Annihilation of an electron and positron pair occurs chiefly by two or three quantum emission according as the total spin of the particles is 0 or 1 respectively. Both bound and unbound states of the positron-electron system can occur. The bound states, constituting positronium, are of exceptional interest in view of the analogy with the hydrogen atom, and the fundamental nature of the two component particles. Positron and positronium lifetimes are discussed. (auth)

5786

MEASUREMENT OF LOW-ENERGY GAMMA-RAY PAIR CROSS SECTIONS IN SCINTILLATORS USING A SCINTILLATION PAIR SPECTROMETER. Harry I. West, Jr. (Stanford Univ., Calif.). Phys. Rev. 101, 915-21(1956) Feb. 1.

Using a three-crystal pair spectrometer with pulse-height selection on the side crystals, absolute and relative γ-ray pair production cross sections were measured in anthracene and sodium iodide, respectively, by making the center crystal of the spectrometer out of these substances. The experimental data were reduced to yield the following pair cross sections (γ-ray energies in Mev given in brackets): carbon, $\sigma(1.17) = (1.16 \pm 0.05) \times 10^{-28}$ cm^2, $\sigma(1.33) = (6.03 \pm 0.18) \times 10^{-28}$ cm^2; iodine, $\sigma(1.17) = (1.36 \pm 0.05) \times 10^{-26}$ cm^2, $\sigma(1.33) = (6.81 \pm 0.17) \times 10^{-26}$ cm^2, $\sigma(2.76)/\sigma(1.38) = 15.0 \pm 0.8$. These results are compared with those of other experimenters and with theoretical calculations. (auth)

5787

ENERGY DISTRIBUTION AT LARGE ANGLES OF HIGH-ENERGY ELECTRONS IN BREMSSTRAHLUNG. David G. Keiffer and George Parzen (Univ. of Notre Dame, Ind.). Phys. Rev. 101, 1244-5(1956) Feb. 15.

The energy distribution of high-energy electrons, that have been scattered by the nuclear potential and have lost energy by bremsstrahlung, has been investigated. It has been found that there is a peak in the energy distribution which occurs at energies of the order of mc^2. The nature of and reasons for the peak are discussed. Formulas for the energy distribution near the peak and for the area under the

peak are given. Similar results apply also to pair production. (auth)

5788
THE MULTIPLE SCATTERING OF 4.5 MEV ELECTRONS. F. F. Heymann and R. E. Jennings (Univ. Coll., London). Proc. Roy. Soc. (London) A234, 116-24(1956) Jan. 24.

The multiple scattering of 4.5-Mev electrons by foils of Al, Cu, Mo, Ag and Pt has been determined, using a photographic method to measure the variation of scattered electron intensity with angle. It was found that the results were in good agreement with the Molière theory into the region of plural scattering, this being the upper limit of angles covered by the observations. (auth)

GASES

5789 NACA-TN-3558
Iowa State Coll., Ames.
HEAT CAPACITY LAG OF GASEOUS MIXTURES. Thomas D. Rossing, Robert C. Amme, and Sam Legvold. Aug. 31, 1954. 35p.

A study was made of the vibrational energy lag in heavy organic gases. Results of measurements of sonic dispersion made with an acoustic interferometer in a number of heavy gases are presented and certain fundamental properties of the vibrational excitation process in these gases are discussed. (auth)

Refer also to abstracts 5514, 5530, and 5781.

INSTRUMENTS

5790 AD-69015
Baldwin-Lima-Hamilton Corp., Philadelphia.
HIGH TEMPERATURE STRAIN GAGE RESEARCH. Supplementary Report. Francis G. Tatnall. Apr. 15, 1955. 51p. Contract AF33(616)-2365.

The advances made in the field of high-temperature strain gage development are reported. Details of all work reported in the five progress reports submitted previously are given. (F.S.)

5791 AECU-3171
General Electric Co. General Engineering Lab., Schenectady, N. Y.
A REPORT ON THE CALIBRATION OF TWO EIGHT-INCH MAGNETIC FLOWMETERS—MARK 1-2 AND MARK II. Eugene R. Astley. Nov. 10, 1954. 31p. (R54GL303).

Methods of calibration were explained for verification of the theoretical performance of 8-in. magnetic flowmeters used in other than ideal entry conditions. The flowmeter should have a calibration accuracy within ±3% of the full scale of 3400 gal/min. (F.S.)

5792 AERE-CE/R-1779
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks. England.
THE DESIGN AND PERFORMANCE OF SMALL CLIMBING FILM EVAPORATORS. D. Pepper. Apr. 1956. 33p.

A review of available design data for climbing film evaporators is presented. Sufficient data are given to enable small-diameter evaporators to be designed for the evaporation of aqueous or similar liquids. The measurement of entrainment and corrosion rates in small climbing film evaporators is described. It is shown that entrainment is worse than in pot-type evaporators but that it can be reduced to an acceptable level by a suitable entrainment separator. The corrosion rate in the evaporator is no higher than that obtained in static corrosion tests on the same materials. (auth)

5793 AERE-EL/M-42
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
CORONA DISCHARGE TUBE STABILISATION. T. A. J. Jaques. Apr. 1950. 16p.

The suitability of a Corona tube as a voltage stabilizer was confirmed. Dry air appeared to be satisfactory as a filling. Construction materials for anode and cathode are those easy to obtain, work and process by conventional methods. (F.S.)

5794 AWRE-O-29/54
Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
THE MEASUREMENT OF SMALL UNBALANCED IMPEDANCES AT RADIO FREQUENCIES. A. B. Hillan. Mar. 30, 1954. 26p.

The construction and performance of a bridge for the measurement of small unbalanced impedances down to about 0.1 ohms at radio frequencies in the range 0.1 mc/s to 5 mc/s is described. Consideration is given to the sources of error in the equipment and it is considered that the frequency range is capable of extension up to at least 30 mc/s. (auth)

5795 BRL-971
Ballistic Research Labs., Aberdeen Proving Ground, Md.
A SURVEY OF DOMESTIC ELECTRONIC DIGITAL COMPUTING SYSTEMS. Martin H. Weik. Dec. 1955. 292p. DA Project No. 5B0306002.

The engineering characteristics, logical features, operating experiences, cost factors and personnel requirements of eighty four different domestic digital electronic computing systems are described. An analysis of the computer field, a discussion of trends and a complete glossary of computer field, a discussion of trends and a complete glossary of computer engineering and programming terminology are included. (auth)

5796 CF-56-5-30(Sect. A)
Oak Ridge National Lab., Tenn.
TESTING PROCEDURES FOR REACTOR INSTRUMENTATION. SECTION A. A-1 LINEAR AMPLIFIER (Q-541). H. E. Banta and S. H. Hanauer. Feb. 8, 1954. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The components of the Al linear amplifier are described, their specifications given, and their operating characteristics reviewed. Circuit diagrams are given, and testing procedures are outlined. (D.E.B.)

5797 CF-56-5-30(Sect. C)
Oak Ridge National Lab., Tenn.
TESTING PROCEDURES FOR REACTOR INSTRUMENTATION. SECTION C. MAGNET AMPLIFIER (Q-889). H. E. Banta and S. H. Hanauer. Feb. 8, 1954. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Magnet amplifiers supply current to electromagnets which suspend reactor scram rods. The operation of the Q-889 amplifier is described, its specifications given, circuitry shown, and testing procedures outlined. (D.E.B.)

5798 CF-56-5-30(Sect. G)
Oak Ridge National Lab., Tenn.
TESTING PROCEDURES FOR REACTOR INSTRUMENTATION. SECTION G. PERIOD AMPLIFIER (Q-1093). H. E. Banta and S. H. Hanauer. Feb. 8, 1954. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The period amplifier is a coupling device between the log N amplifier and the sigma amplifier for indicating the time rate of changes of the logarithm of flux. The operating characteristics of this amplifier are discussed, its specifications given, and testing procedures outlined. (D.E.B.)

5799 CF-56-5-30(Sect. H)
Oak Ridge National Lab., Tenn.
TESTING PROCEDURES FOR REACTOR INSTRUMENTATION. SECTION H. FAST SERVO AMPLIFIER (Q-1095). H. E. Banta and S. H. Hanauer. Feb. 8, 1954. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The servo amplifier is a part of the regulating rod drive system, preceded by a neutron chamber and followed by an amplidyne. Circuitry for this amplifier is given, its operating characteristics discussed, and service and testing procedures outlined. (D.E.B.)

5800 CF-56-5-30(Sect. K)
Oak Ridge National Lab., Tenn.
TESTING PROCEDURES FOR REACTOR INSTRUMENTATION. SECTION K. ORNL PRECISION PULSER (Q-1066). H. E. Banta. Feb. 8, 1954. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The design and testing of a pulse generator for precise amplitudes are reviewed. Calibration within 1% is believed possible at a variable output amplitude between 500 μv and 100 mv. (D.E.B.)

5801 CF-56-5-30(Sect. P)
Oak Ridge National Lab., Tenn.
TESTING PROCEDURES FOR REACTOR INSTRUMENTATION. SECTION P. COMPOSITE SAFETY AMPLIFIER (Q-1565). J. B. Ruble and S. H. Hanauer. Mar. 7, 1955. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

The composite safety amplifier combines on one chassis the functions of a sigma amplifier, safety preamp, period amplifier, and magnet amplifier. The operation of this amplifier is discussed, and its circuitry given. (D.E.B.)

5802 ORNL-2093
Oak Ridge National Lab., Tenn.
CLOSED-LOOP LEVEL INDICATOR FOR CORROSIVE LIQUIDS OPERATING AT HIGH TEMPERATURES. A. L. Southern. June 4, 1956. 53p. Contract W-7405-eng-26. $9.30(ph OTS); $3.60(mf OTS).

A closed-loop control system to be used as an indicator of the level of high temperature liquids contained in a tank indicates a level within ± one % of the actual level when coil and core operate at a controlled temperature of 1100° ± 50°F. A hot-rolled steel core was used, but a cobalt core could operate at higher temperatures. (F.S.)

5803 WAPD-SFR-PD-107
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].
HYDROGEN GAUGE DEVELOPMENT IN D LOOP. Final Report. W. Godsin. [1956]. 17p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Measurements of H concentration in pressurized H_2O streams were successfully made through the development of a Pd diffusion gage. The gage design and test results are reported. Satisfactory operation in the range 520 to 580°F is indicated by the results. Characteristics are: linear temperature effects, a linear log relationship of response time and H concentration, and no poison effects. (D.E.B.)

5804 WADC-TN-55-10
Westinghouse Electric Corp., East Pittsburgh, Penna.
THE CONSTRUCTION OF A HIGH TEMPERATURE, HIGH GRADIENT FURNACE. R. C. Hall. Feb. 1955. 15p. Project title: MAGNETIC MATERIALS. Task title: SOFT MAGNETIC MATERIALS. Contract AF33(616)-309. (AD-69137).

For the growth of single crystals in sheet material of Fe and Fe alloys by the strain-anneal method, it was necessary to construct a high-temperature high-gradient furnace. The interior of the furnace consists of a water-cooled Cu block, the lower end of which is projected into the hot zone and partially protected by fire brick. The heat is supplied by a 50-ft length of B and S. gage 25, Pt wire which is wound on a high-temperature porcelain tube and covered by Alundum cement. Two Cu tubes for admission of a protective atmosphere of He are brazed to opposite sides of the block, and a large brass tube which projects above the furnace is brazed into the center of the block. This tube carries a snug-fitting plug which holds the pointed specimen. The furnace, which requires little maintenance and produces a high temperature and a high-temperature gradient (a maximum of about 1500°C/in.), will yield satisfactory experimental results. (auth)

5805 NACA-TM-1184
DEVELOPMENT AND CONSTRUCTION OF AN INTERFEROMETER FOR OPTICAL MEASUREMENTS OF DENSITY FIELDS. (Entwicklung und Bau eines Interferenzgerätes zur Optischen Messung von Dichtefeldern). Th. Zobel. Translated by Mary L. Mahler from Deutsche Luftfahrtforschung, Forschungsbericht Nr. 1008, June 30, 1938. 33p.

A method of interference is described and its physical foundation and a simple method of adjustment are briefly discussed. The special technical construction of the instrument is described which guarantees its use also in the case of vibrations of the surrounding space and permits the investigation of unsteady phenomena. It is found that the interference method will make the small differences in density in the flow field around bodies optically measurable even at low speeds (40 m/sec). (auth)

5806
ELECTRON OPTICAL METHOD FOR STUDYING THE DYNAMICS OF THERMAL PROCESSES IN OPAQUE MEDIA = G. V. Spivak, and T. N. Dombrovskaya. (Moscow Lomonosov State Univ.) Doklady Akad. Nauk S.S.S.R. 106, 39-41(1956) Jan. 1. (In Russian).

A secondary emission microscope of weak magnification, with magnetic focusing, and a specially designed cathode was used to observe thermal wave expansions in an opaque media. The object investigated, which served as secondary emission cathode, was bombarded by low velocity primary electrons. The secondary electrons, accelerated to several kilovolts, were focused on a fluorescent screen by an iron lens which simultaneously magnetizes the object. Aquadag film served as the anode. The mechanism of the process is based upon changes of electron density on the surface of a cathode modulated by local fields. The spiralling of the trajectories on magnetic induction lines produced the modulating effect. The experiments were made with four types of cathodes, two of which had copper inclusions, in pure nickel magnets. A bifilar tungsten spiral was inserted into the cathode openings which heated the cathode. At the Curie temperature, the ferromagnetic behavior, and transitions into paramagnetic states could be observed on the screen. The third cathode was made from 0.2mm nickel strips with silicate admixtures of 0.5, 1, 2, and 3%, and one diamagnetic copper strip in the middle. The strips with higher silicate content had a lower Curie point and correspondingly were placed closer to the heat source, producing good contrast. The fourth cathode was made of ferrite because of its higher heat resistance. The pictures of the magnetic transitions and temperature wave expansion are given. (R.V.J.)

5807
A PORTABLE SCINTILLATION INSTRUMENT FOR USE IN GEOLOGY. Hans Schneider (Justus Liebig Inst., Giessen, Germany). Z. angew. Phys. 7, 413-16(1955) Aug. (In German).

ISOTOPES

5808
CATALOG AND PRICE LIST OF RADIOISOTOPES—SPECIAL MATERIALS AND SERVICES. Available from Oak Ridge National Lab., Radioisotopes Sales Dept., Oak Ridge, Tenn.

ISOTOPE SEPARATION

5809 JENER-41
Joint Establishment for Nuclear Energy Research, Kjeller, Norway.
PRODUCTION OF RADIOACTIVE PHOSPHORUS-32 FROM PILE-IRRADIATED SULPHUR. Knut Samsahl. Apr. 25, 1956. 8p.

A method for extracting P^{32} from pile-irradiated S has been developed for routine production of carrier-free P^{32}. Covering recent improvements it consists in boiling the S with water containing a small amount of 2-octanol as wetting agent. After removal of the 2-octanol by distillation the pure water solution of P^{32}, in the form of orthophosphate, is filtered off from the S and eventually concentrated. A description of an apparatus, useful for extractions of up to 500 g S, and the different working stages of a typical separation process are given. The chemical and radiochemical purity of the final P^{32} solution is discussed, and a determination by activation analysis of the amount of S contamination is described in detail. The extraction yield is on average 93% for 5 μ-micronized S and 76% for S sublimatum. Without addition of phosphate carrier the over-all yield is slightly smaller. The separation process requires about 3 hours. (auth)

5810 NP-5992
Goteborg. Chalmers Tekniska Högskola. Institutionen för Fysik.
ISOTOPE ENRICHMENT BY COUNTERCURRENT ELECTROMIGRATION IN MOLTEN SALTS (thesis). Arnold Lundén. 1956. 114p.

Up to the present date isotopes of Li, Cl, K, Cu, Zn, Br, Ag, Cd, Tl, and Pb have been enriched by countercurrent electromigration in molten chlorides, bromides and nitrates. The theory of the experiments is reviewed briefly and systematical relations between the observed mass effects are discussed. Different properties of the separation columns are studied. Glass packed columns have 20 to 50 theoretical plates per cm length while quartz packed columns have 5 to 10. Attempts by various methods to enrich isotopes of Li, Mg, Cl, K, Ca, Cu, Zn, Ga, Br, Rb, Sr, Ag, Cd, In, Sn, rare earths, Tl, and Pb are reviewed. (auth)

5811 AERE-Lib/Trans-616
THE PREPARATION AND USE OF CONCENTRATES OF Li^6 AND Li^7. A. Klemm. Translated by F. Hudswell from Z. Elektrochem. 58, 609-10(1954). 5p.

5812
PERFORMANCE OF A HOT-WIRE THERMAL DIFFUSION COLUMN. J. W. Corbett and W. W. Watson (Yale Univ., New Haven, Conn.). Phys. Rev. 101, 519-22(1956) Jan. 15.

The performance of a carefully constructed, metal, hot-wire, thermal diffusion column is examined in the regions of laminar and turbulent gas flow in the column for several hot-wire temperatures using the normal argon isotopic mixture as a column gas. A new experimental method is employed which simplifies and increases the accuracy of the experiment. At the lowest temperature examined, quantitative agreement with theory is observed without the use of a parasitic remixing factor. The effect of spacers on the center wire on column performance was also examined. No significant effect was observed, this being attributed to the careful construction of the column. (auth)

MATHEMATICS

5813 BRL-855
Ballistic Research Labs., Aberdeen Proving Ground, Md.
RANDOM NUMBER GENERATION ON THE BRL HIGH-SPEED COMPUTING MACHINES. M. L. Juncosa. May 1953. 28p. Project No. TB3-0007K.

Procedures requiring very few orders and storage for generation of pseudo-random numbers on the ORDVAC, EDVAC, and ENIAC are described. The results of some statistical tests performed on some numbers produced by the method on ORDVAC are given. A mathematical appendix contains the number-theoretic background and theorems used in the description of the method. (auth)

5814 CIT-ORD-6D-TR27
Carnegie Inst. of Tech., Pittsburgh.
A NOTE ON POISSON'S INTEGRAL. Technical Report No. 27. R. J. Duffin. Apr. 25, 1956. 9p. Project title: MATHEMATICAL ANALYSIS OF ELECTRICAL AND MECHANICAL SYSTEMS. Contract DA-36-061-ORD-490.

Let a continuous function f be defined on the boundary of a convex region. Of concern in this note is a simple mean value formula which extends f to be a continuous function at all points of the region. If the region is a sphere it is shown that the extended function is harmonic in the sphere. It follows that for a sphere this mean value formula is equivalent to the well-known integral formula of Poisson. (auth)

5815 ORNL-2105
Oak Ridge National Lab., Tenn.
A MONTE CARLO METHOD OF CALCULATING THE RESPONSE OF A POINT DETECTOR AT AN ARBITRARY POSITION INSIDE A CYLINDRICAL SHIELD. C. D. Zerby. June 25, 1956. 24p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A Monte Carlo method of calculating the response of a point detector at an arbitrary position inside a cylindrical shield is described. The general procedure is developed to obtain the maximum amount of information from each history and to minimize the statistical error. (auth)

5816 RM-1433(RAND)
RAND Corp., Santa Monica, Calif.
BACKGROUND, DEVELOPMENT, AND EXTENSIONS OF THE REVISED SIMPLEX METHOD. William Orchard-Hays. Apr. 30, 1954. 66p.

A comprehensive discussion is given of the development of the Simplex method as used in the Rand codes for the IBM 701 calculator. (D.E.B.)

5817
ON A CHARACTERISTIC PROPERTY OF THE NUCLEAR LINEAR OPERATOR. I. Ts. Gokhberg and A. S. Markus (Bel'tskiĭ State Padagogical Inst.) Doklady Akad. Nauk S.S.S.R. 105, 893-6(1955) Dec. 11. (In Russian).

Refer also to abstracts 5880 and 5976.

MEASURING INSTRUMENTS AND TECHNIQUES

5818 AERE-EL/R-1851
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE MEASUREMENT OF RADIOACTIVITY IN THE HUMAN BODY BY NaI–Tl SCINTILLATION COUNTERS. R. B. Owen. Feb. 2, 1956. 12p.

5819 ARE-H-7/53

Gt. Brit. Armament Research Establishment, Fort Halstead, Kent, England.

DOSE RATES FROM GROUND CONTAMINATED WITH FISSION PRODUCTS OF U^{235} AND Pu^{239}. G. C. Dale, R. A. Kendall, and J. C. McKendrick. May 1953. 23p.

This report evaluates the dose from beta particles and gamma photons from a plane source of fission products. The evaluation has been carried out for both U^{235} and Pu^{239} as the fissionable material, and dose rates have been tabulated and plotted against time, from 1 hr to 3 yr. The difference between the dose rates from the two fissionable materials is not great at the times considered. Expressions have been derived for β dose rates from a thin infinite plane source averaged over a clothed and unclothed man. At times less than 24 hr, average clothing absorbs less than 40% of the β radiation. The ratio of β rep to γ roentgens has been tabulated for various times. This ratio does not decrease monotonically with time. Effective energies of the γ and β spectra are given. As these quantities may be derived by several methods, the particular definitions used in this paper are given, and their significance and limitations discussed. (auth)

5820 CEA-336

France. Commissariat à L'Énergie Atomique, Paris.

NOUVELLES METHODES D'ENREGISTREMENT ET DE DEPOUILLEMENT ELECTROMECHANIQUES DES NUMERATIONS DE PARTICULES. (New Methods for Electromechanical Recording and Analysis of the Number of Particles). R. Meunier, M. Bonpas, and J. P. Legrand. 1954. 11p.

The principles and construction of an electromagnetic register are described. This registration automatically gives the activity of a radioelement, the decay curves, the activity of a neutron detector, and neutron density ratios. (B.J.H.)

5821 CF-56-5-30(Sect. J)

Oak Ridge National Lab., Tenn.

TESTING PROCEDURES FOR REACTOR INSTRUMENTATION. SECTION J. COMPENSATED CHAMBER-FIELD TESTING (Q-1045). J. C. Gundlach and S. H. Hanauer—H. E. Banta, ed. Feb. 8, 1954. 8p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The compensated chamber, used for reactor neutron flux measurements, consists of two chambers, one B coated. The B-coated chamber measures both neutron and gamma flux; the uncoated chamber, gamma flux only. Being of opposite potential, the uncoated chamber compensates for the gamma flux in the coated chamber giving neutron flux only. The fabrication and calibration of this chamber are outlined. (D.E.B.)

5822 K-1285

Oak Ridge Gaseous Diffusion Plant, Tenn.

A COUNT REGISTER FOR ALPHA HAND AND FOOT COUNTERS. G. M. Lindner and H. C. Woodall. June 19, 1956. 16p. Contract W-7405-eng-26. $0.20(OTS).

A Count Register has been developed for use with the Four-Fold Alpha Hand Counter to automatically provide a visual over- or under-tolerance indication of the contamination exhibited by an individual during a 9.4 sec monitoring interval. The register device utilizes the output of a Model C Poppy Radiation Meter to drive a stepping relay, which lights either a white lamp for under-tolerance or a red one for over-tolerance. The relay automatically resets to zero when the next pair of hands is inserted between the hand counter probes. A printing mechanism has also been designed and constructed to permanently record the over or under-tolerance indication of the Count Register on a standard IBM card. (auth)

5823 NARF-55-88T

CONVAIR, Fort Worth, Tex.

CALIBRATION OF A COMPENSATED ION CHAMBER FOR USE AS A GAMMA DETECTOR. E. A. Kostyniak and C. W. Dickenson. Jan. 25, 1956. 28p. Contract AF33(038)-21117. (MR-N-109).

5824 NRL-4743

Naval Research Lab., Washington, D. C.

FILTERED X-RAY SPECTRA. Interim Report. L. C. Thompson. Apr. 16, 1956. 21p. Project Nos. NE-101-505-3 and NR-662-100.

Energy spectra of filtered x rays have been measured with a NaI scintillation spectrometer. Various thicknesses and combinations of Cu, Sn, and Pb were used as filters at nine tube potentials between 34 and 300 kv. The attenuation of the roentgen field by each filter was also measured. Curves are given showing various properties of the spectra. By the use of proper filters, a very high filtration can produce spectra with a full width at half maximum of about 10% at almost any bombarding energy. A spectral distribution with a full width at half maximum of 20% allows photon intensities 20 to 50 times greater than those obtainable with a half width of 10%. In addition, a method is given to correct for the energy resolution of the scintillation spectrometer. (auth)

5825 AEC-tr-2482

A MEASURING APPARATUS FOR MAGNETIC FIELDS. A. Kohaut. Translated from Z. tech. Phys. 18, 198-9(1937). 6p.

An apparatus, operating according to the fundamental rule of the rotating coil in a magnetic field, for measuring magnetic fields is described. Fields of 0.1 gauss can be measured with an accuracy greater than 1%. (F.S.)

5826

THE USE OF SCINTILLATORS IN DOSIMETRY. I. M. Rosman and K. G. Zimmer. Z. Naturforsch. 11b, 46-52 (1956) Jan. (In German).

5827

RECTANGULAR WILSON CHAMBER WITH BILATERAL EXPANSION. V. G. Kirillov-Ugriumov, V. M. Federov, and B. N. Deriagin (P. N. Lebedev Inst. of Physics). Soviet Phys. JETP 1, 484-7(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 603-7(1955) May. (In Russian).

5828

HIGH THRESHOLD SCINTILLATION NEUTRON DETECTOR. P. S. Baranov and V. I. Gol'danskii (P. N. Lebedev Inst. of Physics). Soviet Phys. JETP 1, 576-8(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 621-3(1955) May. (In Russian).

Diagrams are given of a high threshold scintillation neutron detector using a cylindrical crystal phosphor, and its operating characteristics are described. (B.J.H.)

5829

POSSIBLE APPLICATION OF PULSED MULTIPLIER IMAGE-CONVERTERS FOR RECORDING TRACKS OF IONIZING PARTICLES IN LUMINESCENT MEDIA. G. A. Askar'yan. Soviet Phys. JETP 1, 575-6(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 626-7(1955) May. (In Russian).

One of the most promising methods by which a detector of this type may be utilized is described. The basic part of the detector is a magnetically focused, pulsed image converter designed for the intensification of the luminous image of the tracks of particles in a luminescent phosphor. The track is projected on the photocathode of the image converter by an optical system. The advantages and disadvantages of such a system are discussed. (B.J.H.)

5830
GAS BUBBLE CHAMBER—A POSSIBLE RECORDER OF THE ELEMENTARY ACT OF INTERACTION OF IONIZING RADIATION WITH MATTER. G. A. Askar'yan. Soviet Phys. JETP 1, 571(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 636(1955) May. (In Russian).

The feasibility of recording the tracks of ionizing particles by using a supersaturated solution of gas in the liquid of a bubble chamber is briefly discussed. (B.J.H.)

5831
THE FLUX OF SECONDARY IONIZING PARTICLES IN A UNIFORMLY IRRADIATED HOMOGENEOUS MEDIUM OF VARYING DENSITY: APPLICATION TO WALLED IONIZATION CHAMBERS. G. Failla (Columbia Univ., New York). Radiation Research 4, 102-9(1956) Feb.

5832
A REVISED TECHNIC FOR FILM DOSIMETRY AT OAK RIDGE NATIONAL LABORATORY. Edwin D. Gupton (Oak Ridge National Lab., Tenn.). Radiology 66, 253-8(1956) Feb.

A film-badge meter was developed which gives good performance when used for the determination of the dosage and energy of radiation when exposure is to roentgen rays only; dosage when exposure is to γ rays only; approximate dose for exposure to β rays only, and approximate dose for exposure to mixed β and γ rays. A modification to this film badge is described which utilizes a system of filters for determination of the dosage from mixed radiations may be made more accurately and with no increase in time and training beyond that required for the present method of determining the probable total reading. (C.H.)

5833
A Th^{227} ACCIDENT. P. F. Gustafson and L. D. Marinelli (Argonne National Lab., Lemont, Ill.). Radiology 66, 268-9 (1956) Feb.

Methods of measurement are described which were used in determinations of the radioactive body burden following accidental injection of Th^{227} into the finger. Measurements were complicated by the fact that the γ ray spectra from newly prepared Th^{227} solution is replaced by that due to a number of radioactive daughters which grow into secular equilibrium with the Th^{227} parent within a few days. (C.H.)

5834
EXTRAPOLATION CHAMBER MEASUREMENTS WITH Ni^{63} BETA RAYS. C. Wingate and G. Failla (Columbia Univ., New York). Radiology 66, 270(1956) Feb.

Ionization current measurements made with different small spacings and different gas pressures using Ni^{63} and a source of β rays in one of the plates in an extrapolation chamber led to the conclusion that proper extrapolation can be obtained at low gas pressures provided certain precautions are taken. These precautions are discussed briefly. (C.H.)

5835
RESPONSE OF PHOTOGRAPHIC EMULSIONS TO CHARGED PARTICLES AND NEUTRONS. E. Tochilin, B. W. Shumway, and G. W. Kohler (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Radiology 66, 270-1(1956) Feb.

The radiation dosage sensitivity to 340-Mev protons, 190-Mev and 24-Mev deuterons, and 380-Mev α particles were determined for three dosimeter films and one nuclear emulsion. Results are discussed briefly. (C.H.)

5836
DETECTORS FOR CHARGED PARTICLES FROM STRIPPED EMULSION LAYERS. A. A. Varfolomeev. Uspekhi Fiz. Nauk 57, 701-13(1955) Dec. (In Russian)

A review of photoemulsion development methods is given. (R.V.J.)

5837
LENGTH OF SCINTILLATION IN THE VAVILOV-CHERENKOV EFFECT. I. M. Frank. Uspekhi Fiz. Nauk 58, 111-50(1956) Jan. (In Russian).

A general review is given of secondary factors contributing to prolonging scintillation effects. Experiments are made with Vavilov-Cherenkov effects and luminescence in refracting and in non-dispersive media. Light beam attenuation in spectra, achromatic counters, and the Vavilov-Cherenkov radiation counters are discussed. (R.V.J.)

5838
INVESTIGATION OF C^{14} WITH THE SCINTILLATION DETECTOR. Hans Schneider (Justus Liebig Inst., Giessen, Germany). Z. angew. Phys. 7, 409-13(1955) Aug. (In German).

Work on the measurement is discussed, and comparisons with the scintillation counter in various arrangements are made. A photosecondary electron intensifier, suitable for a practical method, was investigated. (tr-auth)

5839
HIGH PRECISION MASS SPECTROMETER FOR LEAD ISOTOPES. H. Fr. Ehrenberg, J. Geiss, and R. Taubert (Univ. of Bonn, Germany). Z. angew. Phys. 7, 416-23(1955) Aug. (In German).

5840
RESPONSE OF SODIUM IODIDE CRYSTALS TO ALPHA PARTICLES AND ELECTRONS AS A FUNCTION OF TEMPERATURE. E. der Mateosian, M. McKeown, and C. O. Muehlhause (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 101, 967-71(1956) Feb. 1.

In an attempt to determine the mechanism causing the lower scintillation efficiency of α particles in NaI(Tl) crystals relative to the scintillation efficiency of electrons, the response of pure NaI and thallium-activated NaI crystals to α particles and electrons was studied as a function of temperature. Crystals were grown for this investigation both by the Bridgman and Kyropoulos methods. The magnitude of the scintillations per unit of energy loss in the crystals varied with temperature in a way which agreed with predictions of qualitative theories. The ratio of the α-particle response to the electron response per unit energy, though a constant with temperature for the crystals grown by the Bridgman method (α response/e^- response = ~0.7) showed an interesting temperature dependence for crystals grown by the Kyropoulos method. For a "pure" NaI crystal grown by the Kyropoulos method this ratio attained a value as high as 1.5 at −150°C, indicating that the α particle was more efficient than the electron at this temperature. In view of this, proposed explanations for the lower efficiency at room temperature such as "local saturation" of scintillation centers or the loss of energy by "hard collisions" are re-examined. A temperature-dependent effect in the resolution of α-particle peaks is also reported and discussed. (auth)

5841
ROLE OF OXYGEN IN THE QUENCHING OF LIQUID SCINTILLATORS. H. H. Seliger, C. A. Ziegler, and I. Jaffe (National Bureau of Standards, Washington, D. C.). Phys. Rev. 101, 998-9(1956) Feb. 1.

The quenching effects of oxygen on the light outputs of several organic liquid scintillators have been compared under conditions of high-energy gamma irradiation and direct light excitation of the solute. The reduction of oxygen of the light output has been found to be primarily due to solute quenching. Results are obtained which support the collision-transfer mechanism proposed by Kallmann. (auth)

5842
COUNTING SUSPENSIONS IN LIQUID SCINTILLATORS. F. Newton Hayes, Betty S. Rogers, and Wright H. Langham (Los Alamos Scientific Lab., N. Mex.). Nucleonics 14, No. 3, 48-51(1956) Mar.

Techniques for high-efficiency scintillation counting are

developed. Materials insoluble in toluene were pulverized and added directly to a stock scintillator. (D.E.B.)

5843

NITROUS OXIDE DOSIMETER FOR HIGH LEVELS OF BETAS, GAMMAS, AND THERMAL NEUTRONS. P. Harteck and S. Dondes (Rensselaer Polytechnic Inst., Troy, N. Y.). Nucleonics 13, No. 3, 66, 68, 70 & 72(1956) Mar.

A simple high-level dosimeter for β, γ, and thermal neutron radiation was found in the use of N_2O, which decomposes proportionately with dosage. Experiments were conducted at BNL which indicate the operation of this type dosimeter in the range 104 to 10^{10}r. (D.E.B.)

5844

LIQUID-SCINTILLATION COUNTING FOR ASSAY OF TRITIUM IN URINE. George T. Okita, James Spratt, and George V. LeRoy (Argonne Cancer Research Hospital, Chicago). Nucleonics 14, No. 3, 76-9(1956) Mar.

A simple, rapid, and sensitive liquid-scintillation method for monitoring the urine of worker exposed to tritium is described. (D.E.B.)

5845

RECENT DEVELOPMENTS IN GLASS DOSIMETRY. Norbert J. Kreidl and Gerald E. Blair (Bausch and Lomb Optical Co., Rochester, N. Y.). Nucleonics 14, 82-3(1956) Mar.

A glass has been formulated which responds linearly to radiation in the range 10^3 to 10^6 r. This glass is suggested for use in high-level dosimetry. (D.E.B.)

5846

AUTOMATIC NEUTRON-FLUX SCANNER. R. T. Frost and E. B. Fehr (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 14, 84, 86 & 88(1956) Mar.

Flux distribution in reactors may be measured by irradiating a long, thin U strip and counting the induced activity. An automatic device for scanning such strips is described. (D.E.B.)

5847

β-RAY SPECTROSCOPY IN THE PRECISION RANGE OF $1:10^5$. K. Siegbahn and K. Edvarson (Institute of Physics, Uppsala, Sweden). Nuclear Phys. 1, No. 3, 137-59(1956).

An iron-free double focusing β spectrometer for precision work is described. Several conversion lines in the spectrum of ThB + C have been measured absolutely, using a method which eliminates the measurement of the magnetic field. By combining several β spectroscopic data, one can calculate the elementary constant combination h/m_oc. The result is in excellent agreement with results obtained by other means This is a sensitive check on the accuracy of the individual Bq values of the different lines. (auth)

5848

APPLICATION OF CdS PHOTORESISTANCE IN COMBINATION WITH PHOSPHORS AS THE DETECTOR OF COBALT 60 GAMMA RAYS. S. D. Margolin and I. G. Fakidov (Urals Inst. of Metal Physics) Doklady Akad. Nauk S.S.S.R. 105, 976-7(1955) Dec. 11. (In Russian).

The photoresistance of a CdS monocrystal was tested in a scintillation counter with naphthalene, toluene, cesium iodide, and sodium iodide, and Co^{60} isotope with 0.6g-equivalent of radium as a gamma radiation source. The tables show CdS photoresistance without the phosphors and with various phosphor combinations. The highest sensitivity was observed in the presence of sodium iodide. The results of the study showed that CdS can be used as an effective detector of γ rays. (R.V.J.)

5849

SOME OPTICAL PROPERTIES OF THE NEW ZINC SULFIDE PHOSPHORS, ACTIVATED BY RARE EARTH ELEMENTS. Z. A. Trapeznikova, and V. V. Shchaenko. (Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 106, 230-2(1956) Jan. 11. (In Russian).

Rare-earth-activated zinc sulfides have been obtained by adding some fusing agent and the coactivators. Experiments with annealing in atmospheres of H_2S, NH_3 and N_2, and in vacuum produced the following systems: ZnS–Nd, ZnS–Pr, ZnS–Sm, ZnS–Dy, ZnS–Er, ZnS–Tm, and ZnS–Eu. Variations in the spectra of activated ZnS phosphors in relation to the annealing atmosphere indicate that various luminescent centers are formed under different atmospheric conditions. The experiments established that the luminescence of the trivalent rare earth ions of these phosphors results from the transition energy which is absorbed by the substances and from special centers absorbing in the narrow range of ~333mμ. (R.V.J.)

5850

ON THE MECHANISM OF PULSE FORMATION IN SEMICONDUCTING CRYSTALLINE COUNTERS. S. M. Ryvkin. (Leningrad Physico-Technical Inst.) Doklady Akad. Nauk S.S.S.R. 106, 250-3(1956) Jan. 11. (In Russian).

A study is made of pulse formations in crystalline counter semiconductors (crystals possessing finite, balanced conductivity up to the point of excitation produced by ionizing particles) in the more important cases of large electrical fields, and a criteria is established to determine the transition from the mechanism of the "primary current" to the mechanism of the "open current." (R.V.J.)

5851

NUCLEAR RADIATION DETECTORS. J. Sharpe. London, Methuen & Co. Ltd., 1955. 179p. New York, John Wiley & Sons, Inc.

The interaction of nuclear radiations with matter is discussed. Operating characteristics and efficiencies of ionization and scintillation counters are reviewed. (C.W.H.)

5852

ON THE γ-PARTICLE DISCRIMINATION IN THE CORPUSCULAR PHOTOGRAPHY METHOD. Pierre Cuer and Henri Braun. Compt. rend. 242, 486-9(1956) Jan. 23. (In French).

An attempt was made to apply the ideas of P. Cuer on the granular dispersion of the latent images from various radiations to the corpuscular problems of γ,α and α,p or β,α and β,p discriminations. For Ilford C_2 and E emulsions, 1.50 μ,α and p tracks were obtained in acceptable clouding for a maximum γ intensity of the order of 30,000 r and fast β intensity of $\sim 2 \times 10^{11}/cm^2$. For Ilford G5, one can allow ~1,000 r. (tr-auth)

5853

THE EFFECT OF ANGLE OF INCIDENCE OF BETA PARTICLES ON CERTAIN PHOTOGRAPHIC FILM MEASUREMENTS. D. S. Mathewson (Univ. of Queensland, Brisbane, Australia). Brit. J. Radiol. 29, 63-4(1956) Jan.

5854

A METHOD OF CALCULATING ISODOSE CURVES FROM CENTRAL AXIS DEPTH DOSE DATA. F. W. Tranter (Christie Hospital and Holt Radium Inst., Manchester, England). Bit. J. Radiol. 29, 92-4(1956) Feb.

The method described permits calculation of isodose curves from any self consistent depth dose data such as that presented in the recent Survey of Central Axis Depth Dose Data, and applies to fields of any shape, both at medium energies and in the megavoltage region. It is simple and speedy in use and the basic charts prepared from central axis data may be rapidly replaced if the data changes. A new method of extending scatter : radius curves to large radii is described, which avoids the use of a formula and consequent fitting. (auth)

5855

PHYSICAL BASIS FOR AN ESTIMATE OF THE IONIZATION

DENSITY IN A MATERIAL IRRADIATED WITH X OR γ RAYS. Licia De Marco. Atti accad. sci. Ferrara 32, 1954-1955. 10p. (In Italian).

5856
MEASUREMENT WITH THE PHOTOGRAPHIC METHOD OF THE DISTRIBUTION IN DEPTH OF THE IONIZATION PRODUCED BY Co^{60} GAMMA RAYS. Licia De Marco. Atti accad. sci. Ferrara 32, 1954-1955. 11p. (In Italian).

5857
DOSAGE ESTIMATION IN RADIOTHERAPY AND THE WHEATLEY INTEGRATOR. Boyce Worthley, John Tooze, Joan Brown, and Robert M. Fry. Acta Radiol. Suppl. 128, 1955. 170p.

5858
CRITERIA FOR THE CONSISTENT COUNTING OF DELTA RAYS ON HEAVY NUCLEAR TRACKS IN EMULSION PLATES Otis B. Young and William C. Ballowe (Southern Illinois Univ., Carbondale). Am. J. Phys. 24, 157-9(1956) Mar.

This paper is an attempt to improve greatly the consistency of delta-ray counting along tracks of heavy nuclei in emulsions is reported. The problem is complicated and, unless satisfactory criteria are properly followed, variable results may be expected both from a given scanner and from different scanners. A set of criteria are given. Considerable information regarding their use is included. This work is adapted to nuclei with Z's of ten or greater. (auth)

MESONS

5859 NP-5883
Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
EAST-WEST ASYMMETRY OF POSITIVE AND NEGATIVE MESONS. Technical Report No. 67. Frank B. Harris, Jr. Dec. 15, 1955. 61p. Contract N5ori-07806.

The intensities of positive and negative μ mesons at zenith angles of 45° in the east-west plane and at the vertical have been measured at atmospheric depth 548 g cm^{-2} near the geomagnetic equator. The equipment used selects either positive or negative mesons in two fairly broad, overlapping momentum bands. The data are analyzed through use of the unidimensional equation for μ-meson production employed by M. Sands and by S. Olbert which, due to the finite zenith angle, must be extended to include not only the east-west asymmetry of the primary radiation but also the effect of the curvature of the trajectories of the mesons in the terrestrial magnetic field after their production. Olbert's expression for the production spectrum of μ-mesons is adopted, viz.: $G(R') = 7.31 \times 10^4 (a + R')^{-3.58}$ (g^{-2} cm^{-2} sec^{-1} $sterad^{-1}$). Olbert gives a curve of the parameter a as a function of geomagnetic latitude. Actually, it is of more fundamental interest to examine its dependence upon M_c, the effective cutoff magnetic rigidity, which may vary with both geomagnetic latitude and longitude. The present work converts Olbert's a (λ) into $a(M_c)$, for values of M_c from zero up to about 14 Bv. The data yield values of a which in the west lie far below Olbert's curve and in the east far below any reasonable extrapolation of it. In other words, the counting rates at 45° east and west are much larger than might be expected. The discrepancy is many times too large to be a result of the statistical errors of the experiment. A closer examination of the problem shows that the lack of collimation in the production of the π mesons, together with certain effects due to the solid angle of the equipment, is sufficient to account for the anomalous effect described above. By making a reasonable assumption regarding the mean square angle of production of π mesons, it is possible to derive from the data a value of a at 45° west which lies on Olbert's curve. Under the same assumption, the curve can easily be extended to pass through the 45° east point. Since Olbert's expression includes the effect due to non-collimation at the vertical, a new μ-meson production spectrum can be derived, differing from the original one only in its normalization. The result is $G(R') = 7.73 \times 10^4 [R' + a(M_c)]^{-3.58}$ which holds everywhere on the earth's surface and in any direction of incidence. The data do not indicate the presence of any appreciable number of negatively charged particles in the primary cosmic radiation. (auth)

5860 AEC-tr-2489
THE POLARIZATION OF ELECTRONS IN THE DECAY OF POLARIZED μ-MESONS. L. B. Okun'. Translated by V. Rimsky-Karsakoff from Doklady Akad. Nauk S.S.S.R. 104, 840-2(1955). 5p.

The possibility of determining the g_1 constants by measuring the correlation of the spins of the decaying μ-meson and of the electron which is emitted during the decay was investigated. The measurement of the polarization of the electrons in the decay of the polarized μ-meson made it possible to fully determine the value of these g_1 constants. (F.S.)

5861 AEC-tr-2492
THE INTERACTION OF 300 MEV π^--MESONS WITH PROTONS, DEUTERONS, AND NUCLEI IN NUCLEAR EMULSIONS. L. S. Dulkova, T. A. Romanova, I. B. Sokolova, L. V. Sukhov, K. D. Tolstov, and M. G. Shafronova. Translated from Doklady Akad. Nauk S.S.S.R. 107, 43-6(1956). 4p.

Emulsions were prepared with lithium acetate containing H and D. These emulsions were irradiated in a synchrotron π^- beam at 300 ± 3 Mev. A total of 1580 interactions in the H and D plates were observed. Mean free paths and scattering cross sections are shown. The stars observed are tabulated with respect to the number of prongs. (D.E.B.)

5862 AERE-Lib/Trans-613
FISSION OF HEAVY NUCLEI BY SLOW π^- MESONS. N. A. Perfilov and N. S. Ivanova. Translated by J. B. Sykes from Zhur. Eksptl'. i Teoret. Fiz. 28, 732-4(1955). 4p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-6738.

5863
DOUBLE SCATTERING OF PSEUDOSCALAR MESONS. Alexander H. Barrass (St. Patrick's Coll., Manooth, Ireland). Proc. Roy. Irish Acad. 57A, 137-49(1955) Nov.

Differential cross sections are calculated and total cross-sections estimated for double scattering of pseudoscalar mesons. The calculations and assumptions made are discussed. (D.E.B.)

5864
ON THE ANGULAR DISTRIBUTION OF DOUBLE PION PRODUCTION IN PION-NUCLEON COLLISIONS AT 1.4 BEV. Daisuke Ito and Shigeo Minami (Tokyo Univ. of Education and Osaka City Univ., Japan). Progr. Theoret. Phys. (Japan) 14, 482-6(1955) Nov.

An angular distribution of doubly produced pions in pion-nucleon collisions at 1.4 Bev is analyzed by the aid of phase space consideration, making some simple assumption on the transition matrix elements of the processes. (auth)

5865
THE ANOMALOUS MAGNETIC MOMENT OF THE μ-MESON. Shunkichi Hirokawa, Hiroo Komori (Nagoya Univ., Japan), and Shuzo Ogawa (Hiroshima Univ., Japan). Progr. Theoret. Phys. (Japan) 14, 494-5(1955) Nov.

Cosmic-ray μ-meson bursts were analyzed, and the upper limit for the anomalous magnetic moment set at 80% of the normal Dirac moment. Energy losses due to ionization, bremsstrahlung, pair production, and $\mu-\pi$ creation are considered. (D.E.B.)

5866

ON THE PROBLEM OF THE NEGATIVE π-MESON DECAYS. V. I. Gol'danskii and M. I. Podgoretskii (P. N. Lebedev Inst. of Physics). Soviet Phys. JETP 1, 571-2(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 620(1955) May. (In Russian).

Negative π-meson decays in photographic emulsions are analyzed. It is concluded that the observed π-μ decays occurred in the K shell of the light mesonic atom of (C,N,O) nuclei. The contradictions implied by such a conclusion are briefly discussed. (B.J.H.)

5867

MASS-RATIO METHOD APPLIED TO THE MEASUREMENT OF L-MESON MASSES AND THE ENERGY BALANCE IN PION DECAY. Walter H. Barkas, Wallace Birnbaum, and Frances M. Smith (Univ. of California, Berkeley). Phys. Rev. 101, 778-95(1956) Jan. 15.

A comprehensive series of measurements made on the masses of L-mesons produced by the 184-inch cyclotron is reported. A general ratio principle of measurement is employed which largely eliminates systematic errors. The particular method that has been developed is described in detail. The theory of nonequilibrium particle orbits in the cyclotron field is worked out to provide formulas from which momenta may be calculated, and to obtain the momentum distribution functions determined by the target and detector dimensions. The energy-loss processes in nuclear track emulsion, which is used as a stopping material and detector, are studied and the range-momentum exponent q is found. Several small corrections to the mean range are made. A number of range straggling effects are evaluated. The theoretical distribution of the quantity Rp^{-q} (R being the range and p the momentum) is studied, and the first three moments of the distribution are calculated explicitly. The distribution is found to be closely gaussian. From the theory of the distribution of Rp^{-q}, the best estimate and the statistical uncertainty of the mass ratio (e.g., of meson to proton) are evaluated. A number of effects influencing the ratio are studied, but all the corrections found are very small. The measurement of the momentum acquired by the muon when a pion decays has also been treated. Several important relations connecting this quantity with the particle masses are then introduced. Apparatus developed for the application of the ratio principle is described. A number of experiments in which mesons and protons of similar velocities were detected in the same nuclear track plate are reported. Each experiment was repeated a number of times. The measurements of particle ranges and orbit parameters, the magnetic field measurements, the dimensional tolerances, the calculations, and other important details are discussed. The following mass ratios are reported: π^+/proton = $0.1488_7 \pm 0.00011$, $\pi^-/\pi^+ = 0.998 \pm 0.002$, $\pi^+/\mu^+ = 1.321 \pm 0.002$. The center-of-mass momentum acquired by the muon in positive pion decay was measured as 29.80 ± 0.04 Mev/c and its energy, 4.12 ± 0.02 Mev. All the results are consistent if the rest mass of the neutral particle in the pion decay is zero. With this assumption, the measurements further imply that the positive pion-muon mass difference is 66.41 ± 0.07 electron masses. The derived masses, in units of the electron mass, are: $\pi^+ = 273.3 \pm 0.2$, $\pi^- = 272.8 \pm 0.3$, $\mu^+ = 206.9 \pm 0.2$. (auth)

5868

Λ^0 BINDING IN LIGHT NUCLEI. G. Wentzel (Univ. of Chicago). Phys. Rev. 101, 835-7(1956) Jan. 15.

In an attempt to study the forces by which the hyperon Λ^0 is bound in light hyperfragments, several assumptions are made: (1) perturbation theory is adequate; (2) vertices like $N \rightarrow \Lambda^0 + \theta^0$ are dominant; (3) the spin of the θ is 0 or 1, and the spin of the Λ is $\frac{1}{2}$ or $\frac{3}{2}$; (4) there are no attractive contact potentials; (5) Λ—nucleon forces are much weaker than nucleon-nucleon forces. If these assumptions are granted, the trend of the binding energy of the Λ as a function of the mass number can be predicted for each coupling type. Certain assignments of spin and parity $[(s_\Lambda, s_\theta) = (\frac{1}{2}^+, 0^+), (\frac{1}{2}^-, 1^-)$, and $(\frac{3}{2}^-, 1^-)]$ can be ruled out, because in these cases a Λ cannot be bound by H^3, He^3, or heavier nuclei, contrary to experimental findings. (auth)

5869

CHARACTERISTICS OF K^+-PARTICLES. D. M. Ritson, A. Pevsner, and S. C. Fung (Massachusetts Inst. of Tech., Cambridge); M. Widgoff (Harvard Univ., Cambridge, Mass.); G. T. Zorn (Brookhaven National Lab., Upton, N. Y.); and S. Goldhaber and G. Goldhaber (Univ. of California, Berkeley). Phys. Rev. 101, 1085-93(1956) Feb. 1.

A large nuclear emulsion stack was exposed in the magnetically analyzed beam of K^+ particles, at the Berkeley Bevatron. The secondaries of stopped K mesons have been analyzed, and examples of all the known modes of decay: $K_{\mu 2}$, $K_{\pi 2}$, K_{e3}, $K_{\mu 3}$, τ, and τ' have been identified. The decay processes of the $K_{\mu 2}$, $K_{\pi 2}$, and τ' mesons have been confirmed, and a possible decay scheme for the $K_{\mu 3}$ has been considered. The masses of the particles decaying in the different ways have been determined from momentum-range measurements, and for $K_{\mu 2}$ and $K_{\pi 2}$ particles, from the Q of the decay as well. The masses of all the particles are consistent with a value of 965 m_e, within about 10 m_e. The relative frequencies of the various modes of decay have been estimated, and by comparison with other data, it is found that the apparent lifetimes of all the particles are $\sim 1 \times 10^{-8}$ sec. (auth)

5870

EVIDENCE FOR THE ELECTROMAGNETIC PRODUCTION OF μ MESONS. G. E. Masek and W. K. H. Panofsky (Stanford Univ., Calif.). Phys. Rev. 101, 1094-1109(1956) Feb. 1.

Direct electromagnetic production of pairs of μ mesons has been investigated. The means of detection chosen consists of searching for the production of single negative μ mesons peaked sharply in the forward direction. The target chosen was aluminum, bombarded by bremsstrahlung from 575-Mev electrons, and the angular range studied was $10° < \theta < 30°$. The experimental value of the cross section σ_{exp} was referred to a theoretical value σ_{theor} computed by modifying the conventional formula for the pair production of fermions by photons in a Coulomb field by the introduction of a finite nuclear size. Observations carried out to date give $\sigma_{exp}/\sigma_{theor} = 1.93 \pm 0.68$. The quoted standard error defines the statistical accuracy only and is a measure of the likelihood of existence of the process; in addition, the absolute cross section is uncertain to within a factor of 1.5. (auth)

5871

SCATTERING OF 217-MEV POSITIVE PIONS ON HYDROGEN. Horace D. Taft (Enrico Fermi Inst. for Nuclear Studies, Chicago). Phys. Rev. 101, 1116-27(1956) Feb. 1.

The total and differential cross section for the scattering of 217-Mev positive pions on hydrogen has been measured in nuclear emulsions. The total cross section, excepting Coulomb scattering, was found to be (151.0 ± 18.2) mb. The angular distribution in the center of mass was fitted by $d\sigma/d\Omega = (5.22 \pm 1.42) + (7.53 \pm 2.57) \cos\chi + (20.36 \pm 4.61) \cos^2\chi$ mb/steradian, assuming S and P waves only. A phase shift analysis was carried out using the method of maximum likelihood. The phase-shift solution in agreement with the requirements of causality and corresponding to the preferred solution of de Hoffman et al, was $\alpha_3 = -22.5° \pm 5.8°$, $\alpha_{33} = 114.0° \pm 7.4°$, and $\alpha_{31} = -11.6° \pm 9.7°$. The angular distribution showed strong forward scattering and a preference for positive Coulomb interference, in agreement with the hypothesis of a resonance in the state with angular momentum $\frac{3}{2}$ and isotopic spin $\frac{3}{2}$. (auth)

5872
DISINTEGRATIONS PRODUCED IN NUCLEAR EMULSIONS BY 1.5-BEV NEGATIVE PIONS. R. D. Hill, E. O. Salant, and M. Widgoff (Brookhaven National Lab., Upton, N. Y.) and J. Crussard and W. D. Walker (Univ. of Rochester, N. Y.). Phys. Rev. 101, 1127-30(1956) Feb. 1.

The stars produced in nuclear emulsions by 1.5-Bev π^- mesons are analyzed. The numbers of stars as a function of the numbers of prongs are obtained and compared with stars produced by protons of similar energies. The angular distributions of prongs from the pion-produced stars are also derived. An example of the decay of a hyperfragment He^{5*} emerging from a pion star is described and the production of K particles by 1.5-Bev pions is noted. (auth)

5873
PION-PROTON SCATTERING AT 150 AND 170 MEV. J. Ashkin, J. P. Blaser, F. Feiner, and M. O. Stern (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 101, 1149-58(1956) Feb. 1.

The pion-proton differential scattering cross sections have been measured at 150 and 170 Mev. Measurements were made at eight angles using scintillation counters and a liquid hydrogen target. Statistical errors are of the order 5 percent or less. Phase shift analyses of the data have been made on the assumption that the total isotopic spin is conserved and that only s and p waves are appreciably scattered. The angular distributions give no positive indication of any d-wave scattering. (auth)

5874
PARTIAL WAVE ANALYSIS OF THE EXPERIMENTAL PHOTOMESON CROSS SECTIONS. K. M. Watson (Univ. of Wisconsin, Madison) and J. C. Keck, A. V. Tollestrup, and R. L. Walker (California Inst. of Tech., Pasadena). Phys. Rev. 101, 1159-72(1956) Feb. 1.

The experimental data concerning photopion production is studied for photon energies below 400 Mev. The data are analyzed in terms of S- and P-waves of the final pion-nucleon system, and an indication is obtained of the importance of higher partial waves. The "(3,3) state" matrix elements seem to be significantly larger than the other P-wave matrix elements at energies below 400 Mev, but not at high energies. The energy dependence of the various partial waves can be understood on the basis of rather general arguments. In addition to the S-wave and "enhanced" P-wave matrix elements involving the (3,3) state, first order correction terms from the other, nonenhanced P-waves are included in the theory. This provides a fairly satisfactory description, for energies below about 350 Mev, of the positive and neutral photopion cross sections in hydrogen, and of the ratio of π^- to π^+ production from deuterium. (auth)

5875
RATIO OF K^- MASS TO K^+ MASS. Francis H. Webb, Warren W. Chupp, Gerson Goldhaber, and Sulamith Goldhaber (Univ. of California, Berkeley). Phys. Rev. 101, 1212-14 (1956) Feb. 1.

In order to compare the K^--meson mass to the K^+-meson mass, nuclear emulsion stacks were exposed to the focused K^+ and K^- beams of the Bevatron, maintaining the geometry constant and reversing the magnetic field in the focusing spectrometer. The methods used for the mass determination are described in detail, and the mass ratio thus obtained is $M_{K^-}/M_{K^+} = 0.998 \pm 0.013$. The K^- mass is given as $M_{K^-} = 963 \pm 12\ m_e$. (B.J.H.)

5876
HEAVY MESON FLUXES AT THE COSMOTRON. G. Harris, J. Orear, and S. Taylor (Columbia Univ., New York). Phys. Rev. 101, 1214-15(1956) Feb. 1.

A momentum analyzed K-meson beam was obtained at the Brookhaven Cosmotron using a combination of two strong-focusing magnetic quadrupoles followed by a deflecting magnet. The beam was scanned by following gray tracks picked up at a heavy meson residual range of 2 cm. Results on the relative frequencies of K mesons agree well with those obtained at Berkeley. (B.J.H.)

5877
HEAVY-MESON DECAYS AND THE SELECTION RULE $|\Delta I| \leq \frac{1}{2}$. Gregor Wentzel (Enrico Fermi Inst. for Nuclear Studies, Chicago). Phys. Rev. 101, 1215-16(1956) Feb. 1.

It is pointed out that various features of the θ and τ meson decays may be interpreted as favoring the selection rule for the total isotopic spin I such that $\Delta I = 0$ for fast transitions and $\Delta I = \pm\frac{1}{2}$ for slow transitions. The branching ratios of θ and τ decays are cited as arguments for the validity of this selection rule. (B.J.H.)

5878
METHOD FOR DETERMINING SPINS OF HYPERONS. S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 101, 1216-17(1956) Feb. 1.

Suggestions are made for an experimental method which may be used to determine the spins of the Λ° and Σ hyperons. The method consists in studying angular correlation effects in the decay of hyperons produced in the capture of K^- mesons by protons. A brief theoretical analysis is given. (B.J.H.)

5879
ANOMALOUS V^0-EVENTS AS THREE-BODY DECAYS. J. Ballam, M. Grisaru, and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 101, 1438-40(1956) Feb. 15.

Possible three-body decay schemes are suggested for V^0 particles. Some 27 events, which are consistent with at least one of these schemes, have been extracted from published data, and these events are analyzed. (B.J.H.)

5880
EFFECTIVE POTENTIAL OF THE π-MESON-NUCLEON INTERACTION. V. R. Velibekov and V. A. Meshcheryakov. (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 105, 951-4(1955) Dec. 11. (In Russian).

Experimental data indicate that in the process of π-meson scattering from 200-Mev nucleons, S and P waves play an important part. α_3, which passes 90° at 200 Mev, is the most important of all P-wave phases. The data on S waves show that $\alpha_3 < 0$ and $\alpha_1 < 0$ are approximately linear. Several methods of S and P wave analysis are given. (R.V.J.)

5881
DOUBLY CHARGED RENORMALIZATION GROUP IN PSEUDOSCALAR MESON THEORY. D. V. Shirkov. (Steklov Inst. of Mathematics). Doklady Akad. Nauk S.S.S.R. 105, 972-5(1955) Dec. 11. (In Russian).

The method of renormalization is adapted to pseudoscalar meson theory, i.e., to the system of nucleon spinor and pseudoscalar meson fields with pseudoscalar interaction. A special case of a doubly charged group is investigated. (R.V.J.)

5882
NUCLEAR INTERACTIONS OF π^- MESONS IN COPPER. N. M. Kocharyan, G. S. Saakyan, M. T. Aĭvazyan, Z. A. Kirakosyan and A. S. Aleksanyan. (Armenian Inst. of Physics) Doklady Akad. Nauk S.S.S.R. 105, 1204-7(1955) Dec. 21. (In Russian).

A special study of proton and π-meson formation spectra, produced by neutrons in graphite, aluminum, copper, and lead was carried out. The measurements were taken at high elevation, in a magnetic spectrometer. The magnetic field intensity was taken at 7100 gauss; and a field of $10 \times 17.8 \times 69.1$ cm. A $32 g/cm^2$ lead absorber (to absorb the electron-photon components) was placed over the installation and a $40 g/cm^2$ graphite absorber was placed underneath. Copper absorbers of 10.6; 18.3; 23.1; 36.4; 52.9; and $35.6 g/cm^2$ were

distributed in the magnet clearances. The experiments recorded 500 π mesons with E $\geq$ 510 Mev. Tabulations of these mesons, according to their energy range, are given. The phenomena of star formation, the nuclear scattering and the disappearance or stopping of particles were observed during the studies of the particle nuclear interactions in the copper absorber. (R.V.J.)

5883
ON WEAK INTERACTIONS BETWEEN HYPERONS AND HEAVY MESONS. Bernard d'Espagnat and Jacques Prentki. Compt. rend. 242, 740-2(1956) Feb. 6. (In French).

Refer also to abstracts 5758, 5906, and 6072.

METEOROLOGY

5884
TURBULENCE IN SURFACE LAYER INVERSIONS. A. B. Kazanskiĭ and A. S. Monin. (Inst. of Geophysics). Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz. 79-86(1956) Jan. (In Russian).

Surface air layer turbulence is studied on the basis of the theory of congruency, which establishes the existence of universal functions for the wind velocity and temperature distribution at a given altitude, as well as for the asymptotic appearance of these functions for small and large altitudes. With the aid of the turbulent energy balance equation, interpolation equations are derived for universal functions with which are calculated the nomograms to determine the turbulence process based on gradient measurement data. (tr-auth)

MICROWAVES

5885
MICROWAVE DIELECTRIC CONSTANT MEASUREMENTS. D. W. Magnuson (Carbide and Carbon Chemicals Co., K-25 Plant, Oak Ridge, Tenn.). J. Chem. Phys. 24, 344-7(1956) Feb.

An improved microwave cavity technique for measuring dielectric constants was used to determine the molar polarization, dipole moment, and nonideality of UF_6, freon-114, $C_4Cl_3F_7$, and C_6H_6. Nonideality parameters were calculated for ClF_3 from previous data. (auth)

MOLECULAR PROPERTIES

5886 NP-5890
Carnegie Inst. of Tech., Pittsburgh.
TEMPERATURE DEPENDENCE OF THE HALL COEFFICIENTS IN COPPER-NICKEL ALLOYS. Technical Report No. 2. Floyd E. Allison. Feb. 29, 1956. 78p. Contract Nonr-760(04).

The resistivity and Hall coefficients for Cu-Ni alloys containing 80, 70, and 60% Ni have been measured in the temperature range from 77 to 400°K. The effect of $\partial M/\partial B$ on the ordinary Hall coefficient R_0^* is clearly evident for the 70 and 60% Ni samples near their Curie temperatures even though fields up to 15.5 kilogauss were used. Below this Curie point anomaly the magnitude of R_0^* is found to be in excellent agreement with predictions based on a simple band model. The dependence of the extraordinary Hall coefficient R_1^* upon the resistivity is found to be in agreement with the law $R_1^* = A\,\rho^n$. For 80 and 70% Ni the coefficient A and the exponent n agree with the values obtained for pure Ni. A significant departure from the pure Ni value is observed, however, in the 60% Ni alloy. An extraneous potential that arises from the combined Peltier and Nernst effects is also demonstrated in the 80% Ni alloy at room temperature. This leads to a 5% error in the Hall coefficients when they are determined under what was previously thought to be ideal conditions. Since the error is small and rather difficult to separate from the Hall potential, no attempt is made to eliminate it from the other measurements. (auth)

5887
MELTING CURVES OF H_2, D_2, AND T_2 UP TO 3500 kg/cm^2. R. L. Mills and E. R. Grilly (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 101, 1246-7(1956) Feb. 15.

The melting pressure-temperature relationship of the three hydrogen isotopes has been determined accurately to 3500 kg/cm^2 by the blocked-capillary method. The data were fitted with fair success to the Simon-type equation, $P = a + bT^c$. The melting curves of H_2, D_2, and T_2 are displaced downward on the pressure axis in that order and, at identical temperatures, exhibit approximately equal slopes. (auth)

5888
STORAGE OF ENERGY IN BERYLLIUM OXIDE. H. O. Albrecht and C. E. Mandeville (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 101, 1250-2(1956) Feb. 15.

The photostimulated ultraviolet emission of x-ray excited BeO has been measured as a function of the wavelength of the incident light. A maximum of emission occurs for a stimulating wavelength of ~4100 A. Experiments are described which are interpreted as showing the presence of doubly occupied traps in BeO which are analogous to the F-centers of the alkali halides. Some discussion concerning energy storage in NaCl(Ag) is included. (auth)

5889
VARIATIONS IN THE PHOTOCONDUCTIVITY AND IN THE ELECTRICAL COUNTING PROPERTIES OF DIAMONDS. F. C. Champion and B. Dale (King's Coll., London). Proc. Roy. Soc. (London) A234, 419-32(1956) Feb. 21.

The electrical conductivity produced by β-ray bombardment and by light irradiation in several diamonds was investigated in the temperature range 150 to 500°K. Considerable uniformity was observed in the behavior of the specimens; all of them polarized strongly in the dark at room temperature, and polarization could be effectively eliminated by pulsing the electric field while maintaining the β flux. Both the counting response and the photoconductivity increased as the temperature was lowered. This was interpreted as being largely due to an increase in the mobility of the charge carriers at lower temperatures, the quantitative relationship being consistent with Hall effect measurements. Accumulation of polarization was reduced by irradiation with red light or by elevation of temperature; at 420°K little sign of polarization remained. From various temperature effects, the thermal depths of the trapping levels in these diamonds were estimated at 0.6, 0.8 and 1 ev. (auth)

NEUTRONS

5890 AERE-RP/M-72
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DESIGN OF A LARGE ANTIMONY-BERYLLIUM NEUTRON SOURCE FOR USE WITH EXPONENTIAL ASSEMBLIES. V. S. Crocker and K. J. Kenry. Mar. 7, 1956. 10p. $0.50.

The design of a large Sb-Be neutron source, suitable for exponential experiments is described. Use is made of the usual reactor facilities e.g., use of U unload slug coffin for handling the Sb, to keep the cost down to a minimum. The total neutron output, the Sb being saturated in a flux of 10^{12} n/cm^2/sec, is 1.3×10^{10} n/sec (~1230 c of 1.7 Mev gammas). (auth)

5891 AWRE-O-18/55

Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.

MONTE CARLO METHODS FOR SOLVING NEUTRON PROBLEMS. A. J. Mayne. July 18, 1955. 96p.

The possibilities of applying Monte Carlo methods to several types of neutron problem are discussed. There is a short statement of the types of problem to be solved. The laws of neutron transport through matter are stated, and explicit formulae are given for the calculation of neutron tracks, for systems with and without symmetry. The various kinds of Monte Carlo process in use are described. It is then shown how estimates of desired quantities can be obtained from the results of these processes, and how to estimate the errors of these estimates, determine confidence limits between which the quantities will lie with probabilities approximately equal to preassigned values, and discriminate between pairs of previously stated hypotheses about the quantities. The relative merits of different Monte Carlo processes are assessed, and a comparison is made between the effectiveness of statistical and non-statistical methods of calculation. Some possible new types of Monte Carlo process are mentioned. Finally, there is a guide to the relevant scientific literature. (auth)

5892 NYO-6481

New York Univ., New York. Atomic Energy Commission Computing Facility.

ON THE NUMERICAL INTEGRATION OF THE NEUTRON TRANSPORT EQUATION. Herbert B. Keller and Jack Heller. Sept. 1, 1955. 41p. Contract AT-(30-1)-1480.

A procedure for the direct numerical integration of the steady-state, elastic scattering neutron transport equation is presented. Conditions for the existence, uniqueness and non-negativeness of the numerical solution are obtained. Under these conditions it is shown that the scheme is stable and the numerical solution converges, with refinement of the mesh, to the solution of the transport equation. (auth)

5893

THE ELASTIC AND INELASTIC SCATTERING OF FAST NEUTRONS. II. W. D. Allen (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 7, 69-73 (1956) Feb.

A brief description is given of the ideas which led Weisskopf to propound the 'complex potential' model of nuclear interactions. The study of total neutron cross-section with atomic weight and neutron energy in the range 1 to 4 Mev showed that the cross-sections, instead of decreasing smoothly as the energy increased, showed broad 'resonances'. Weisskopf, using only three parameters, was able to account for the observed results very satisfactorily over the entire range of energy. Calculations of the angular distributions of elastically scattered neutrons at 1 Mev, while not quite so consistent, gave a good account of the observed results, while calculations of the inelastic cross-sections show, up to the present, appreciable discrepancies. (auth)

5894

INELASTIC INTERACTION CROSS SECTIONS OF 120 AND 380 MEV NEUTRONS WITH NUCLEI. V. I. Gol'danskiĭ, A. A. Koval'skiĭ, V. S. Pen'kina, and E. Z. Tarumov. (Inst. of Chemical Physics). Doklady Akad. Nauk S.S.S.R. 106, 219-222(1956) Jan. 11. (In Russian).

Experiments were carried out on the phasatron of the Institute of Nuclear Problems to study the optical nuclear model. The inelastic cross sections of 120 and 380-Mev neutron interactions with heavy nuclei (σ_a) were measured. To determine σ_a, the absorption of primary neutrons was measured on a threshold detector. The results were checked by using several types of detectors (ionization chambers, non-threshold detectors, and fission chambers). Diagrams of 120- and 380-Mev neutron absorption for hydrogen, lead, aluminum, and uranium, and tabulations comparing the data obtained from the experiments and the data of other authors are given. (R.V.J.)

5895

SPIN DEPENDENCE OF THE s-WAVE NEUTRON INTERACTION WITH Li^7. R. G. Thomas, M. Walt, R. B. Walton, and R. C. Allen (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 101, 759-64(1956) Jan. 15.

The angular distributions of the neutrons scattered elastically by Li^7 have been measured at four energies in the vicinity of the p-wave resonance at 256 kev. Pronounced departures from symmetry are observed, the scattering being predominantly forward below resonance and backward above resonance. These departures are analyzed for information on the nature of the s-wave "background" interaction. By taking into account the known values of the coherent and incoherent scattering cross sections at zero energy, it is possible to conclude that the parallel-spin ($J = 2^-$) s-wave interaction is the stronger. Several other examples are cited from the literature on light nuclei which also indicate a stronger parallel-spin s-wave interaction, the magnitudes of the splittings being of the order of 1 Mev. (auth)

5896

ELASTIC SCATTERING OF NEUTRONS BY Li^6 AND Li^7. H. B. Willard, J. K. Bair, J. D. Kington, and H. O. Cohn (Oak Ridge National Lab., Tenn.). Phys. Rev. 101, 765-8 (1956) Jan. 15.

Differential cross sections for elastic scattering of neutrons by Li^6 and Li^7 have been measured in the region of 200- to 600-kev incident energy. The results for Li^6 confirm the assignment of $5/2^-$ for the 7.46-Mev level in Li^{7*} and indicate that the s-wave potential scattering has a statistical channel spin mixture and negative phase shift. Similarly in the case of Li^7, the 2.28-Mev level in Li^{8*} is indeed 3^+, the s-wave potential scattering has very nearly a statistical channel spin mixture, but the phase shift is positive. (auth)

5897

TRANSMISSION OF SLOW NEUTRONS BY LIQUID He^4. II. Louis Goldstein and Henry S. Sommers, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 101, 1235-42(1956) Feb. 15.

The Los Alamos slow-neutron total scattering cross sections in liquid He^4 are analyzed using the general scattering theory expected to be valid at short and medium neutron wavelengths. With the approximate mean kinetic energies and partial mean square forces per liquid atom derived previously, the theory is in fair agreement with the data below about 8 A; it breaks down at longer wavelengths. The analysis of the data is then inverted by attempting to solve the following problem: is it possible to find with the cross-section data a set of liquid parameters, at a given liquid temperature, such that the cross sections computed with them would represent the data at wavelengths larger than 8 to 9 A. This problem receives an affirmative solution inasmuch as the neutron data liquid parameters turn out to be in fair agreement with the approximate liquid parameters obtained by an entirely different method. The scattering cross sections recalculated with the new parameters represent the data fairly well out to 12 to 13 A. A direct, practically experimental, proof has been obtained for the existence of a very large zero-point kinetic energy in liquid He^4 over a wide temperature interval. The significance of these results for the derivation, with neutron and x-ray data, of mean

kinetic and potential energies, and mean square forces, per atom, in liquids is discussed. (auth)

Refer also to abstracts 5491 and 5960.

NUCLEAR PHYSICS

5898 NP-5876

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period October–December 1955. Jan. 1, 1956. 44p.

The $O^{16}(He^3,p)F^{18}$ reaction was used to study the states in F^{18} below about 3 Mev. Proton capture resonances in Ni^{58} and Ni^{60} are reported. The angular distributions of the ground-state and first excited-state α-particle groups from the $C^{13}(He^3,\alpha)C^{12}$ reaction were investigated from 5° to 150° for a bombarding energy of 2 Mev. The angular distributions of protons from the $C^{12}(He^3,p)N^{14}$ reaction were also studied. The theory of deuteron stripping reactions is discussed within the Born approximation. The theory of spin-$\frac{1}{2}$ particles is also discussed. The pulse height spectra for the inelastic scattering of 2.6-Mev neutrons from Fe^{54} and Fe^{57} are given. A block diagram is given for an electronic delay generator for high speed photography. The operating characteristics of an ion source for use in Cockcroft-Walton generators were investigated. Using Monte Carlo calculations, a study was made of the energy lost in NaI(Tl) scintillation crystals by photons from 0.1 to 1.5 Mev. Operating characteristics of a boron trimethyl neutron counter were investigated. Preliminary results are reported on film boiling about a 1-mil W wire immersed in water. Preliminary design values are given for a barge-mounted nuclear power plant. Investigation on the effects of Co^{60} γ radiation on pure ferrous hydroxide sols was continued. The effects of radiation on anthracene were studied. The radiophotoluminescence of lithium benzoate was also studied. (For preceding period see NP-5824.) (B.J.H.)

5899 PR-P-28

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PHYSICS DIVISION PROGRESS REPORT [FOR] OCTOBER 1 TO DECEMBER 31, 1955. 88p. (AECL-282).

Progress is reported on the instrumentation for the Echo Lake Project. Experiments on the $B^{10}(n,\alpha)Li^7$ reaction show the ratio of the ionization of the α particle to the ionization of the Li^7 fragment to be 1.845 ± .020. Experimental information on the excited states of Al^{25} is compared with theory. Relative intensities of the γ rays from the β decay of Na^{25} are tabulated. The lower energy levels of Si^{29} were studied using the reactions $Si^{29}(p,p'\gamma)Si^{29*}$ and $Al^{29}(\beta^-)Si^{29}$. A study was also made of the $Be^9(He^3,p)B^{11}$ reaction. Proton yields from the reaction $C^{12}(He^3,p)N^{14}$ were observed. Progress on nuclear physics instrumentation is reported. The nuclear reactions in stars and the origin of the heavy elements are discussed. The efficiency of a prototype flat single crystal spectrometer was studied. The neutron capture γ rays from F were remeasured. The γ rays from the $B^{10}(n,\gamma)B^{11}$ reaction are also tabulated. Theoretical topics include discussions on surface effects in nuclear reactions and the algebra of decomposition of Kronecker products. (For preceding period see PR-P-27.) (B.J.H.)

5900 UCRL-3413

California. Univ., Berkeley. Radiation Lab.

DESCRIPTION OF A COUNTER EXPERIMENT TO MEASURE THE ELASTIC PROTON-PROTON SCATTERING CROSS SECTION AT BEVATRON ENERGIES (thesis). Charles Wesley Causey. May 14, 1956. 53p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60(mf OTS).

The differential cross section for p-p elastic scattering has been measured as a function of angle at the Bevatron at energies of 0.92, 2.24, 3.49, 4.40, and 6.2 Bev. At each energy, measurements were made out to the largest center-of-mass angle at which the scattering cross section was still detectable. At 2.24, 4.40, and 6.2 Bev measurements were made in to the smallest laboratory angle possible at which the recoil proton of the lower energy was still detectable. These smallest practicable laboratory angles were equivalent to 14.8° (center of mass) at 2.24 Bev, 11° (c.m.) at 4.40 Bev, and 8.3° (c.m.) at 6.2 Bev. The counters and electronics used are described, and some results are presented. (auth)

5901

ANGULAR CORRELATION. O. Hittmair (Univ. of Sydney, Australia). Acta Phys. Austriaca 10, 66-80(1956) Jan. (In German).

Among the possible theoretical and experimental points of view, a review of the field of angular correlations of nuclear radiations is given. The correlation of two coincident radiative rays for the unperturbed case is discussed for all varieties in question. The case whereby external electric or magnetic fields disturb the correlation is treated. It is thereby shown that a sharp separation between statistical and time dependent breakdown is necessary. The relation to the nuclear reaction is pointed out. jj- and LS- coupling are evident in the expression of the correlation formalism. (tr-auth)

5902

USE OF d,n AND d,α REACTIONS IN SOME LIGHT ELEMENTS FOR ANALYTICAL MEANS. Pierre Sue. Compt. rend. 242, 770-1(1956) Feb. 6. (In French).

5903

NUCLEAR EMULSION OBSERVATION OF ANNIHILATION OF AN ANTIPROTON. R. D. Hill, Stig D. Johansson, and F. T. Gardner (Univ. of Illinois, Urbana). Phys. Rev. 101, 907-9(1956) Jan. 15.

A facsimile drawing is shown of an event which occurred in a nuclear emulsion exposed to the proton beam of the Berkeley bevatron and which probably represents the creation and annihilation of an antiproton. (B.J.H.)

5904

ANTIPROTON STAR OBSERVED IN EMULSION. O. Chamberlain, W. W. Chupp, G. Goldhaber, E. Segrè, and C. Wiegand (Univ. of California, Berkeley) and E. Amaldi, G. Baroni, C. Castagnoli, C. Franzinetti, and A. Manfredini (Istituto di Fisica della Universita, Rome) Phys. Rev. 101, 909-10(1956) Jan. 15.

Antiproton stars were observed in emulsions exposed to the beam of the Berkeley bevatron. Mass measurements are tabulated and the ratio of the mass of the particle to the proton mass was found to be 1.02 ± 0.04. (B.J.H.)

5905

MULTIPLE PION PRODUCTION IN n-p COLLISIONS AT THE BEVATRON. William B. Fowler, George Maenchen, Wilson M. Powell, George Saphir, and Robert W. Wright (Univ. of California, Berkeley). Phys. Rev. 101, 911-13(1956) Jan. 15.

More than 500 events showing pion production in n-p collisions were obtained by exposing a H-filled diffusion cloud chamber to high energy neutrons from the Bevatron. An analysis of a seven prong event, which can be interpreted as $n + p \rightarrow p + p + \pi^+ + \pi^+ + \pi^- + \pi^- + \pi^-$ is given, and the relative frequencies of muliplicities of pion production are given. (B.J.H.)

5906

NEGATIVE PIONS FROM NEUTRON BOMBARDMENT OF DEUTERONS. Myron W. Knapp and Wilson M. Powell (Univ.

of California, Berkeley). Phys. Rev. 101, 1110-15(1956) Feb. 1.

In order to obtain information on the neutron-neutron interaction, a cloud chamber filled with deuterium gas was bombarded with the neutron beam of the Berkeley 184-inch synchrocyclotron. The spectrum of the neutron beam, which is produced by 340-Mev protons on a 2.5-inch lithium deuteride target, is peaked at 300 Mev and extends to 340 Mev. The three reactions $d(n,\pi^-p)d$, $d(n,\pi^-pn)p$, and $d(n,\pi^-)He^3$ were studied. A total of 310 events were examined; the three reactions contributed 208, 80, and 22 events respectively. Laboratory-system angular distributions and energy spectra of the mesons are presented. Comparisons with theory indicate agreement with the predictions of the charge-independence hypothesis. (auth)

NUCLEAR PROPERTIES

5907 CRC-628

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

DETERMINATION OF THE NEUTRON CAPTURE CROSS-SECTIONS OF Pu^{242}, Pu^{238}, AND Am^{243}. J. P. Butler, M. Lounsbury, and J. Merritt. Jan. 1956. 8p.

Neutron capture cross sections of Pu^{238}, Pu^{242}, and Am^{243} were determined for pile and thermal neutrons. The pile and thermal values for Pu^{238} are 484 ± 7 and 454 ± 8; for Pu^{242}, 50.6 ± 0.7 and 22.9 ± 0.8; and for Am^{243}, 131.8 ± 1.7 and 81.6 ± 1.8. Resonance integrals are included. (D.E.B.)

5908 CRC-633

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

CROSS SECTIONS OF Pu^{239} AND Pu^{240} IN THE THERMAL AND EPI-CADMIUM REGIONS. F. W. Cornish and M. Lounsbury. Mar. 1, 1956. 40p.

The ratio of total to capture cross section of Pu^{239} was found to be 1.43 for NRX reactor neutrons, 1.60 in the region 0.35 to 0.55 ev, and 1.48 in the region 6 to 100 ev. These values are in good agreement with ratios obtained from mono-kinetic data presented at the Geneva Conference in 1955. The result for the resonance integral of Pu^{240}, 8700 ± 800 barns, is more precise than the values derived from mono-kinetic data; from it a value of 250 ± 35 barns has been derived for the capture cross section of Pu^{240} for reactor thermal neutrons. The experiment involved the irradiation in the NRX reactor of approximately equal, accurately known quantities of plutonium (a) unshielded, (b) shielded with 0.025" Cd, (c) shielded with 0.100" Cd. The unshielded sample had a cobalt wire monitor attached to it in order to measure the flux. No monitors were attached to the shielded samples. After the irradiation, the ratio of fission product activities in the samples was measured by counting gross γ rays from the fission products. Each sample of plutonium was then chemically separated from fission products and aluminum wrappings and mass analyzed. (auth)

5909 IDO-16289

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE TOTAL NEUTRON CROSS SECTION OF THULIUM IN THE ENERGY REGION 0.038 TO 1.56 ev. E. G. Joki and J. E. Evans. May 21, 1956. 18p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

Measurements of the total cross section of thulium as a function of neutron energy were made with the MTR crystal spectrometer. Twelve cylindrical pellets which contained a total of 2.414 grams of metallic thulium were used as a sample. The low energy data can be described by the expression $\sigma(E) = 6.5 + 20.1\ E^{-\frac{1}{2}}$ ev (barns). The extrapolated value for the total cross section at 0.0253 ev is 134 ± 3 barns. (auth)

5910 KAPL-1464

Knolls Atomic Power Lab., Schenectady, N. Y.

A MEASUREMENT OF ETA AND OTHER FISSION PARAMETERS FOR U-233, Pu-239, AND Pu-241, RELATIVE TO U-235, AT SUB-CADMIUM NEUTRON ENERGIES. D. E. McMillan, M. E. Jones, J. B. Sampson, E. R. Gaerttner, and T. M. Snyder. Dec. 15, 1955. 85p. Contract W-31-109-Eng-52. $0.50(OTS).

The average values of η for U^{233}, Pu^{239}, and Pu^{241} in the KAPL Thermal Test Reactor flux below the cadmium cut off were found to be 2.25 ± 0.03, 1.93 ± 0.02, and 2.23 ± 0.05, respectively. It is thought that although the above values for U^{233} and Pu^{239} differ considerably from presently accepted U. S. values, the new values should be better due to an inherent advantage in the present technique. It is shown that if that portion of the present data which is a analogous to previous measurements is analyzed in the same manner as the previous measurements were, the agreement with those results is good. However, it is thought that the previous method of analysis introduces some errors which are avoided in the present method. Values of ν, σ_f, and $1 + \alpha$ are also obtained, but with considerably lower precision. There is some indication that the ν's for thermally induced fission of even-odd nuclei tend to be linearly related to the mass number with a slope equal to that found by others for spontaneous fission of even-even nuclides. (auth)

5911 PD-260

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

RADIATIVE TRANSITIONS IN LIGHT ELEMENTS. II. D. H. Wilkinson. Sept. 1955. 58p.

A survey is presented of present knowledge concerning radiative transitions in nuclei of $A \leq 20$. Over a hundred transitions, chiefly dipole, are analyzed in terms of the Weisskopf units, and the following chief conclusions are drawn: E1 transitions have a most probable speed of about 0.032 Weisskopf units with a spread in speed of about a factor of seven either way; the corresponding quantities for M1 transitions are a speed of 0.15 Weisskopf units and a spread of a factor of 20 either way; these distributions are consistent with shell model expectations; if a transition shows Γ_γ (ev)/E_γ^3 (Mev) > 0.02, then it is very probably E1; there is no clear dependence of transition speed on level spacing or other feature; and some of the higher multipole transitions are inconsistent with shell model expectation and give evidence of collective motion. (auth)

5912 AERE-Lib/Trans-571

THE HYPERFINE STRUCTURE OF THE SPECTRAL LINES AND THE SPINS OF THE NUCLEI OF U^{233} AND Pu^{239}. L. A. Korostyleva, A. R. Striganov, and N. M. Yashin. Translated by V. Beak from Zhur. Eksptl'. i Teoret. Fiz. 28, 471-3(1955). 15p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-5146. (F.S.)

5913

RELATIVE CONVERSION PROBABILITIES IN THE K, L_I AND L_{II} SHELLS OF THE 238.6 KEV γ-LINE OF ThB. E. Sokolowski, K. Edvarson, and K. Siegbahn (Institute of Physics, Uppsala, Sweden). Nuclear Phys. 1, No. 3, 160-3 (1956).

In order to determine the effect, if any, produced by the finite size of a nucleus on its conversion coefficients, a precise measurement was made of the relative intensities of the three conversion lines of the 238.6-kev γ line in Bi^{212} that originate in the K, L_I, and L_{II} shells. The results indicate

that the relative conversion coefficients for this magnetic dipole transition agree well with theory. (B.J.H.)

5914

NUCLEAR RESONANCE FLUORESCENCE IN SOME HEAVY NUCLEI. Franz R. Metzger. J. Franklin Inst. 261, 219-36 (1956) Feb.

Using the Doppler broadening due to thermal agitation and the Doppler shift due to mechanical motion as means of restoring the resonance condition, nuclear resonance fluorescence has been observed from the following isotopes: Pr^{141} (145 kev), Hg^{198} (411 kev), Hg^{199} (209 kev), Hg^{202} (439 kev) and Tl^{203} (280 kev). From the magnitude of the resonance fluorescence effects the following mean lives τ_γ of the gamma-ray transitions have been calculated: $(3.0 \pm 0.4) \times 10^{-9}$, $(3.15 \pm 0.3) \times 10^{-11}$, $(1.2 \pm 0.4) \times 10^{-10}$, $(3.4 \pm 0.7) \times 10^{-11}$ and $(4.7 \pm 0.8) \times 10^{-10}$ second. For the even-even nuclei, the angular distribution of the resonance radiation confirmed spin 2 for the excited state, and spin 0 for the ground state. (auth)

5915

SCATTERING OF 2.62 MEV γ RAYS BY THE ELECTRIC FIELD OF LEAD NUCLEI. Lazare Goldzahl, Philippe Eberhard, Eiichi Hara, and Jacques May. Compt. rend. 242, 484-6(1956) Jan. 23. (In French).

5916

THEORY OF THE RELAXATION BY SEMI-ROTATIONS IN QUADRUPOLE RESONANCE. Joseph Seiden. Compt. rend. 242, 763-6(1956) Feb. 6. (In French).

5917

EFFECT OF PRESSURE ON THE NUCLEAR QUADRUPOLE RESONANCE OF Cl^{35} IN Cl_2Hg. Daniel Dautreppe and Bernard Dreyfus. Compt. rend. 242, 766-8(1956) Feb. 6. (In French).

5918

ON THE JENSEN-MAYER CORRECTION TO THE MAGNETIC MOMENT OF K^{40} WITH INTERMEDIATE COUPLING. Emile Marechal. Compt. rend. 242, 881-3(1956) Feb. 13. (In French).

5919

ON THE EXPANSION OF THE s SHELL OF O^{16}. Bernard Jancovici. Compt. rend. 242, 883-4(1956) Feb. 13. (In French).

5920

ANGULAR CORRELATION OF THE ELECTRON PAIRS FROM THE 4.43 MEV γ RAY OF C^{12}. MEASUREMENT OF THE MULTIPOLARITY OF THIS RADIATION. Serge Gorodetzky, Raymond Armbruster, Pierre Chevallier, and Andre Gallmann. Compt. rend. 242, 898-901(1956) Feb. 13. (In French).

A β scintillation spectrometer was used to measure the angular correlation of electron pairs of internal origin from the 4.43-Mev level in C^{12}. It is concluded that the radiation is electric quadrupole. (B.J.H.)

5921

ON THE CALCULATION OF NUCLEAR MOMENTA ACCORDING TO THE SHELL MODEL. T. Kasseeker and P. Urban. Acta Phys. Austriaca 10, 95-126(1956) Jan. (In German).

5922

L X-RAY ENERGIES OF Np, Pu, AND Am. George L. Rogosa and William F. Peed (Oak Ridge National Lab., Tenn.). Phys. Rev. 101, 591-3(1956) Jan. 15.

Five Np, eight Pu, and five Am L x-ray transitions have been observed in conventional x-ray fluorescence from 200-mg amounts of Np^{237}, Pu^{239}, and Am^{241} using a Cauchois-type curved crystal transmission spectrometer. The energies of these transitions have been determined, with reference to $K\alpha_1$ lines of the elements from Rb through Ag, to an accuracy of 3 to 8 ev. Disagreement with previous measurements by Barton, Robinson, and Perlman; Jaffe, Passell, Browne, and Perlman; and Day has been found while excellent agreement with the Pu measurements of Cauchois, Manescu, and Le Berquier was obtained. (auth)

5923

ELASTIC SCATTERING OF 48-MEV ALPHA PARTICLES. R. E. Ellis and Larry Schecter (Univ. of California, Berkeley). Phys. Rev. 101, 636-44(1956) Jan. 15.

The angular distributions of alpha particles scattered elastically from Ag, Au, and Pb targets have been measured. Deviations by three to four orders of magnitude from pure Coulomb scattering have been observed beyond the forward angles. In addition, some regular structure appears in these distributions, but the main features can be described by an exponential falloff between 25° and 90°. By fitting the data with a simple modification of Blair's scattering theory, it has been possible to determine interaction radii. Nuclear radii have been derived which are an agreement with those found from medium-energy nucleon scattering. (auth)

5924

PROTON CROSS SECTIONS OF Bi^{209}. C. G. Andre, J. R. Huizenga, J. F. Mech, W. J. Ramler, E. G. Rauh, and S. R. Rocklin (Argonne National Lab., Lemont, Ill.). Phys. Rev. 101, 645-51(1956) Jan. 15.

The cross sections for the reactions $Bi^{209}(p,2n)Po^{208}$, $Bi^{209}(p,n)Po^{209}$, and $Bi^{209}(p,\gamma)Po^{210}$ have been measured from proton energies up to 10.65 Mev. The threshold for the (p,2n) reaction is 9.65 Mev (c.m.) which leads to a neutron binding energy for Bi^{210} of $\geq 4.59 \pm 0.14$ Mev. The total cross section as a function of energy agrees with the theoretical calculations for a radius $R = 1.5A^{1/3} \times 10^{-13}$ cm. The energy dependence of the ratio of $\sigma(_{p,2n})/[\sigma(_{p,n}) + \sigma(_{p,2n})]$ corresponds to a nuclear temperature of 4 Mev for Po^{209}. (auth)

5925

DEFORMATION ENERGY OF A CHARGED DROP. I. QUALITATIVE FEATURES. W. J. Swiatecki (Inst. for Mechanics and Mathematical Physica and The Gustaf Werner Inst. of Nuclear Chemistry, Uppsala, Sweden). Phys. Rev. 101, 651-4(1956) Jan. 15.

The qualitative features of the deformation energy of a charged drop are discussed with special reference to the fission process. It is shown that, under conditions more general than the model of an incompressible liquid drop with a sharp surface, the threshold energy for fission should be proportional to $[(Z^2/A)_0 - (Z^2/A)]^3$ near the limit of stability $(Z^2/A)_0$. Similarly, if instability against asymmetry sets in below $(Z^2/A)_c$, the degree of asymmetry of the asymmetric saddle-point shapes which appear should be proportional to $[(Z^2/A)_c - (Z^2/A)]^{1/2}$, and the difference between the symmetric and asymmetric thresholds should be proportional to $[(Z^2/A)_c - (Z^2/A)]^2$. Some factors governing the stability against asymmetry of a strongly deformed drop are discussed qualitatively. (auth)

5926

INELASTIC SCATTERING OF 31-MEV PROTONS FROM BERYLLIUM. J. Benveniste, Reinald G. Finke, and Ernest A. Martinelli (Univ. of California, Berkeley). Phys. Rev. 101, 655-62(1956) Jan. 15.

The range spectrum of charged particles resulting from the bombardment of a thin beryllium foil by 31.3-Mev protons has been measured at several angles. In addition to previously reported energy levels in Be^9 at 2.4, 6.8, and 11.3 Mev, evidence for new levels at 5.0, 7.9, 19.9, and 21.7 Mev was obtained. The angular distribution of each of the proton groups was interpreted in the light of the Austern-Butler-McManus peripheral scattering theory. Deuteron groups corresponding to the Be^8 ground state and first excited states were also identified. The angular distribution of the ground state deuteron group agrees well with the prediction of a modified Butler theory for the (p,d) reaction. (auth)

5927

$B^{10} + \alpha$ REACTIONS. G. F. Pieper and G. S. Stanford (Yale Univ., New Haven, Conn.). Phys. Rev. 101, 672(1956) Jan. 15.

An investigation of the $B^{10}(\alpha,p)C^{13}$ reaction has shown no evidence for the occasionally reported levels in C^{13} at 0.7 Mev and 4.4 Mev. The latter level may in the past have been confused with the ground-state transition in the $B^{10}(\alpha,d)C^{12}$ reaction. (auth)

5928

2– STATE AT 8.87 MEV IN O^{16}. D. H. Wilkinson, B. J. Toppel, and D. E. Alburger (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 101, 673-84(1956) Jan. 15.

The bombardment of F^{19} by protons of energy greater than 3 Mev, and the beta decay of N^{16} are shown to give rise to gamma rays of energies 2.75 ± 0.02 Mev, 1.90 ± 0.03 Mev, and 1.72 ± 0.03 Mev. The first of these gamma rays is in coincidence with gamma rays of 6.1 Mev while the latter two are in coincidence with gamma rays of greater than 6.3 Mev. The relative intensities are in the ratio of 27:1:3, respectively. These observations imply a state at 8.87 ± 0.02 Mev in O^{16} formed in the reactions $F^{19}(p,\alpha)O^{16}$ and $N^{16}(\beta^-)O^{16}$; this state is very probably 2–. The relevance of this observation for the alpha-particle model of O^{16} is discussed. (auth)

5929

DIRECTIONAL CORRELATION OF GAMMA RAYS FROM Sn^{116}. R. P. Scharenberg, M. G. Stewart, and M. L. Wiedenbeck (Univ. of Michigan, Ann Arbor). Phys. Rev. 101, 689-92(1956) Jan. 15.

The directional correlations of successive gamma rays from Sn^{116} have been measured. Sn^{116} decays via 1.09-Mev–1.27-Mev, 1.49-Mev–1.27-Mev, 0.80-Mev–1.27-Mev and 0.40-Mev–2.09-Mev gamma cascades following beta decay from 54-minute In^{116m}. The measured directional correlation functions are in agreement with those expected for 4(Q)2(Q)0, 4(Q)2(Q)0, 2(10% D, 90% Q, 0° phase)2(Q)0 and 2(4% D, 96% Q, 0° phase) 2(Q)0 spin sequences, respectively. (auth)

5930

RADIATION WIDTHS IN THE SLOW NEUTRON RESONANCES OF HAFNIUM. G. Igo and H. H. Landon (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 101, 726 (1956) Jan. 15.

The parameters of the 1.100-ev and the 2.39-ev resonances in hafnium have been determined from total cross section measurements using the Brookhaven crystal spectrometer. The methods of analysis used take into account the Doppler broadening and the finite resolution of the instrument. The radiation widths of the 1.100-ev and the 2.39-ev resonances are 0.067 ev and 0.060 ev, respectively. The remaining one-level parameters for each resonance are presented. (auth)

5931

NUCLEAR LEVELS IN Sr^{88} FROM THE DISINTEGRATION OF Rb^{88} AND Y^{88}. N. H. Lazar, E. Eichler, and G. D. O'Kelley (Oak Ridge National Lab., Tenn.). Phys. Rev. 101, 727-32(1956) Jan. 15.

The nuclear level structure of Sr^{88} has been studied through the γ radiation following the decays of 17.8-minute Rb^{88} and 104-day Y^{88}. Gamma rays from Rb^{88} with energies of 0.909 ± 0.004, 1.39, 1.850 ± 0.008, 2.11, 2.68, 3.01, 3.24, 3.52, 3.68, and 4.87 Mev have been resolved and fitted into a level scheme with the assistance of coincidence spectroscopy using cylindrical 3-inch × 3-inch NaI(Tl) crystals. The intensity of the ground state beta ray transition from Rb^{88} was determined by comparing the total beta ray activity to the intensity of the 1.85-Mev γ ray. It was found that 75.9 ± 5.0 percent of the decays are directly to the ground state. From the γ-ray intensities, the comparative half lives of all the β groups could be determined and, thus, parity assignments were made to all the levels. The relative intensities of γ rays leaving the same level is discussed in relation to single-particle transition probabilities. (auth)

5932

SCATTERING OF 22-MEV ALPHA PARTICLES BY N^{14}. D. W. Miller, B. M. Carmichael, U. C. Gupta, V. K. Rasmussen, and M. B. Sampson (Indiana Univ., Bloomington). Phys. Rev. 101, 740-5(1956) Jan. 15.

The inelastic scattering of 21.5-Mev alpha particles by nitrogen has been investigated. Previously unreported levels at 7.94 ± 0.07, 8.45 ± 0.07, and 10.05 ± 0.07 Mev in N^{14} are observed. Levels at 2.31, 7.4, 7.7, 8.06, and 9.49 Mev reported in other reactions are not observed. This confirms the isotopic spin T = 1 assignment to the 2.31- and 8.06-Mev levels, and suggests such an assignment for the 9.49-Mev level. The status of the 7.4- and 7.7-Mev levels is uncertain. (auth)

5933

FIRST 0^+ LEVEL IN C^{12} AND O^{16}. P. J. Redmond (Columbia Univ., New York). Phys. Rev. 101, 751-2(1956) Jan. 15.

A model is proposed to explain the electric monopole ($0^+ \rightarrow 0^+$) matrix element for the transition between the ground and 7.68-Mev state in C^{12} and between the ground and 6.06-Mev state in O^{16}. In this model the first excited 0^+ state in C^{12} and O^{16} is described by an independent-particle wave function which is identical to the ground-state wave function except for the fact that one of the 1s nucleons in the "alpha-particle core" is replaced by a 2s nucleon. The calculation is performed using harmonic-oscillator wave functions and the results are found to be in excellent agreement with the present experimental information. (auth)

5934

PROTON-INDUCED FISSION CROSS SECTIONS FOR U^{238}, U^{235}, Th^{232}, Bi^{209}, AND Au^{197} AT 100 TO 340 MEV. Herbert M. Steiner (Univ. of California, Berkeley) and John A. Jungerman (Univ. of California, Davis). Phys. Rev. 101, 807-13(1956) Jan. 15.

The total fission cross sections of U^{238}, U^{235}, Th^{232}, Bi^{209}, and Au^{197} for high-energy protons were measured. A cancellation-type ionization chamber was used to detect the fission fragments. The observed fission cross sections are compared to the total inelastic cross sections in order to obtain the relative fission probability as a function of proton energy. (auth)

5935

RELATIVISTIC AND SCREENING EFFECTS IN RADIATIVE ELECTRON CAPTURE. R. J. Glauber and P. C. Martin (Harvard Univ., Cambridge, Mass.); T. Lindqvist (Univ. of Uppsala, Sweden); and C. S. Wu (Columbia Univ., New York). Phys. Rev. 101, 905(1956) Jan. 15.

In order to explain the discrepancies between experimental and theoretical data on the inner bremmstrahlung of A^{37}, calculations were performed taking account of the relativistic effects for the S-state spectrum and including correction factors for screening. (B.J.H.)

5936

PARAMAGNETIC RESONANCE HYPERFINE STRUCTURE OF Co^{60}. W. Dobrowolski, R. V. Jones, and C. D. Jeffries (Univ. of California, Berkeley). Phys. Rev. 101, 1001-5 (1956) Feb. 1.

The microwave paramagnetic resonance hyperfine structure of Co^{60} has been observed in a magnetically dilute single crystal of cobalt ammonium sulfate at 20°K. From the number of hfs components and from their spacing relative to those of Co^{59}, the spin $I(Co^{60}) = 5$ and the magnetic moment $|\mu(Co^{60})| = 3.800 \pm 0.007$ nm are directly determined. These results are discussed in relation to those of

β, γ spectroscopy, nuclear alignment experiments, and the nuclear shell model. (auth)

5937

RELATIVISTIC RADIATIVE TRANSITIONS. W. B. Payne and J. S. Levinger (Louisiana State Univ., Baton Rouge). Phys. Rev. 101, 1020-6(1956) Feb. 1.

The oscillator strength was calculated for electric dipole transitions with retardation between the 1s state and higher discrete states for a single Dirac electron in a Coulomb field. Numerical values for atomic number 82 show that the retarded relativistic oscillator strength for each shell is about 0.8 of the nonrelativistic value. Numerical values are given for the relative intensity of the different K x-ray lines for lead, neglecting screening: the $K\alpha_1/K\alpha_2$ doublet intensity ratio is 1.93 as compared to the NR value of 2.0. An average "oscillator density" is introduced for transitions for discrete states and extrapolated to the series limit to find the photoelectric cross section at threshold. The numerical value for lead of 740 barns is 23% larger than the value given by Hulme et al. The summed oscillator strength was also calculated using a cutoff at an arbitrary high energy to give convergence. The numerical results for lead are insensitive to the numerical value of the cutoff: using 10 Mev, a summed oscillator strength of 0.85 is found with an increase of 0.01 for each factor of two increase in the cutoff energy. The value of the summed oscillator strength is less than that calculated nonrelativistically by Thomas, Reiche, and Kuhn; or relativistically by Gell-Mann, Goldberger, and Thirring. (auth)

5938

CONVERSION OF THE Pt^{196} GAMMA RAYS. M. T. Thieme and E. Bleuler (Purdue Univ., Lafayette, Ind.). Phys. Rev. 101, 1031-3(1956) Feb. 1.

The conversion coefficients of the 331- and 354-kev transitions in Pt^{196}, following electron capture of Au^{196}, were measured with the aid of a lens spectrometer adapted for coincidence measurements. The lower, 354-kev, γ ray is an E2 transition whereas the K-conversion coefficient of the 331-kev γ ray was found to be 18 ± 5% larger than that of a pure E2 transition. From the good agreement of this excess with that expected for the 4.5% M1 admixture derived from angular correlation measurements (18 ± 2%), it is concluded that the fraction of conversion electrons due to an electric monopole transition is 0 ± 5% (standard error). The intensity ratio of the two transitions is 0.278 ± 0.010. (auth)

5939

CLOUDED CRYSTAL BALL ANALYSIS OF THE INELASTIC SCATTERING CROSS SECTION OF A NEUTRON INTO THE ISOMERIC LEVEL ($^{13}/_{2}^{+}$) OF $_{82}Pb^{207}$. Sophie Oleksa (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 101, 1034-8 (1956) Feb. 1.

The clouded crystal ball model was used in the calculation of the cross section for excitation of the 0.8-sec metastable state of $_{82}Pb^{207}$ (Stelson and Campbell's experimental data). Values of X_0^2 were varied from 140 to 172, two values of ζ were considered, $\zeta = 0.03$ and $\zeta = 0.05$, and two values of the radius, $R = 1.45A^{1/3} \times 10^{-13}$ cm and $R = (1.27A^{1/3} + 0.7) \times 10^{-13}$ cm. The clouded crystal ball model and the strong-interaction model both fit the experimental data. The former, however, is extremely sensitive to changes in the parameter X_0^2. The radius $R = 1.45A^{1/3} \times 10^{-13}$ cm fits the data better than $R = (1.27A^{1/3} + 0.7) \times 10^{-13}$ cm. (auth)

5940

NUCLEAR LEVELS AND TRANSITIONS IN Lu^{175} ACCORDING TO THE UNIFIED MODEL. David M. Chase and Lawrence Wilets (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 101, 1038-40(1956) Feb. 1.

The scheme for the decay of Yb^{175} and Hf^{175} to Lu^{175} is analyzed theoretically on the basis of the Bohr-Mottelson strong-coupling unified model. A set of spins and parities for all the levels involved is found to be uniquely consistent with the available experimental data and the level-structure predictions of the model. The anomalously large ratio of M2 to E1 radiation observed in two of the gamma transitions is accounted for as a consequence of configuration forbiddenness. Parallel remarks are made concerning the spectrum of Hf^{177}. (auth)

5941

LOW-LYING LEVELS OF P^{30}. C. Broude, L. L. Green, J. J. Singh, and J. C. Willmott (Univ. of Liverpool, England). Phys. Rev. 101, 1052(1956) Feb. 1.

New states in P^{30} are identified by determination of γ-ray energies from the reaction $Si^{29}(p,\gamma)P^{30}$. The angular distributions of transitions to the ground and first excited states have been determined and spins and parities assigned on the basis of these measurements. The first excited state is thus identified as the first T = 1 state of P^{30}. (auth)

5942

NEUTRON ABSORPTION CROSS SECTIONS OF Pa^{231} AND Pa^{232}. R. R. Smith, N. P. Alley, R. H. Lewis, and A. Vander-Does (Phillips Petroleum Co., Idaho Falls, Idaho). Phys. Rev. 101, 1053-6(1956) Feb. 1.

Activation studies of Pa^{231} in the graphite region of the Materials Testing Reactor have resulted in a value of 200 ± 15 barns for the thermal neutron absorption cross section of Pa^{231}. Resonance neutron effects were eliminated by the method of cadmium differences and by conducting the irradiations in a region where the ratio of resonance to thermal neutrons is small. Measurements of the Pa^{232} and Pa^{233} activities produced in a highly intense neutron irradiation of Pa^{231} have resulted in a value of 760 ± 100 barns for the absorption cross section of Pa^{232}. (auth)

5943

$N^{14}(\alpha,n)F^{17}$ AND $Na^{23}(\alpha,n)Al^{26}$ REACTIONS. W. T. Doyle and A. B. Robbins (Yale Univ., New Haven, Conn.). Phys. Rev. 101, 1056-8(1956) Feb. 1.

The $N^{14}(\alpha,n)F^{17}$ and $Na^{23}(\alpha,n)Al^{26}$ reactions have been studied by two methods, a proton recoil telescope and a slow neutron threshold detector. An energy level in F^{17} at 0.54 ± 0.04 Mev has been observed and a ground state Q value of −4.76 ± 0.07 Mev was determined. Energy levels in Al^{26} were found at 0.3, 1.0, 1.4, 1.8, 2.5, and 2.9 ± 0.2 Mev and a ground-state Q value of −2.9 ± 0.2 Mev was determined. In the latter reaction an excitation curve of the seven-second beta activity in Al^{26} has been observed with a threshold Q of −3.2 ± 0.2 Mev, indicating the presence of an isomeric state in Al^{26} at about 300 kev. (auth)

5944

SEVEN NEW ISOMERS WITH HALF-LIVES BETWEEN 10^{-6} AND 10^{-1} SECOND. Stanley H. Vegors, Jr. and Peter Axel (Univ. of Illinois, Urbana). Phys. Rev. 101, 1067-73(1956) Feb. 1.

Isomers with half-lives greater than 10^{-5} second were sought between the 180-cycle 1-microsecond yield pulses of a 24-Mev betatron. The following new activities were observed:

Bombarded element	Half-life (μsec)	Energy (kev)
As	12,000 ± 3000	305 ± 15
Mo	16.5 ± 1.2	98 ± 5
Pd	33 ± 6	165 ± 15 305 ± 15
W	16.0 ± 1.0	370 ± 15
Tl	65 ± 5	410 ± 15 706 ± 20
Tl	530 ± 50	506 ± 15
Bi	2700 ± 250	500 ± 20 930 ± 30

Additional results include a new half-life determination of Y^{88m} as 287 ± 15 μsec, threshold measurements for several of the activities, and negative results in looking for W^{180m} and Na^{22m}. (auth)

5945

INTERNAL CONVERSION COEFFICIENTS OF Ba^{134}, V^{51}, AND Tl^{203}. Z. O'Friel and A. H. Weber (Saint Louis Univ., Mo.). Phys. Rev. 101, 1076-8(1956) Feb. 1.

The internal conversion coefficients of Ba^{134} (parent, Cs^{134}), V^{51} (parent, Cr^{51}) and Tl^{203} (parent, Hg^{203}) have been measured by the determination of the γ-ray yields from the Compton electron spectra produced in an external converter, employing the analysis of R. G. Thomas and T. Lauritsen and a single magnetic lens β-ray spectrometer. The Ba^{134} results involve the extension of the method to several γ-ray conversions measured simultaneously. V^{51} represents the application of the method to K-capture type of decay for which the direct area-under-curves method cannot be used. Tl^{203} requires the correction of the measured conversion spectrum for photoelectric conversions to obtain the pure Compton events. The values obtained for the total internal conversion coefficients are Ba^{134}: 569-kev γ ray, $(9.2 \pm 1.2) \times 10^{-3}$; 605-kev γ ray, $(5.3 \pm 0.5) \times 10^{-3}$; 796-kev γ ray, $(2.4 \pm 0.3) \times 10^{-3}$; 1.367-Mev γ ray, $(0.49 \pm .05) \times 10^{-3}$; V^{51}: 325-kev γ ray, $(1.5 \pm 0.2) \times 10^{-3}$; Tl^{203}: 279-kev γ ray, for K-shell $(1.5 \pm 0.1) \times 10^{-1}$, and $(4.9 \pm 0.2) \times 10^{-2}$ for the L-shell. In all cases the precision is the standard deviation. The results are in satisfactory agreement with other experimental values and with the predictions of Rose's tables. (auth)

5946

ELECTRIC MONOPOLE TRANSITIONS IN C^{12} AND O^{16}. J. P. Elliott (Atomic Energy Research Establishment, Harwell, Berks, England). Phys. Rev. 101, 1212(1956) Feb. 1.

It is pointed out that the shell-model configurational assignment previously used for the excited O^+ state in a consideration of $O^+ \rightarrow O^+$ electric monopole transitions is not reasonable, and that if the configuration is made consistent with the results of intermediate coupling, the theoretical value of the matrix element of the monopole operator can be made to agree with experiment. (B.J.H.)

5947

ENERGY LEVELS OF Be^8. C. D. Moak and W. R. Wisseman (Oak Ridge National Lab., Tenn.). Phys. Rev. 101, 1326-8(1956) Feb. 15.

The $Li^6(He^3,p)Be^8$ reaction has been used in a study of the levels of Be^8 up to an excitation energy of 14 Mev. The protons were observed with a NaI scintillation spectrometer. The ground state, the 2.9-Mev state, and, tentatively, a 12.3-Mev state were the only levels observed. No evidence was found for levels at 4.05, 4.9, 5.3, or 7.5 Mev. (auth)

5948

RADIATION WIDTHS OF NUCLEAR ENERGY LEVELS. J. S. Levin and D. J. Hughes (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 101, 1328-41(1956) Feb. 15.

The highly excited energy levels formed by capture of slow neutrons can be studied by means of the resonances in neutron cross sections as functions of energy. In the present work the radiation widths of levels in heavy nuclei have been measured by means of total cross section curves obtained with the Brookhaven fast chopper. The "shape," "area," and "interference" methods of analyzing the neutron transmission data are described. The radiation widths obtained, together with results of similar measurements, show that radiation widths of levels in the same nuclide are nearly constant, the observed variations from level to level being of the order of the experimental error. The radiation widths decrease slowly with atomic weight, except for discontinuities at nuclear shells; these discontinuities can be satisfactorily correlated with variations in excitation energy and level spacing at the shells. The variation of radiation width with excitation energy and level spacing is consistent with theoretical calculations for electric dipole transitions; the absolute theoretical widths are too large by an order of magnitude, however. (auth)

5949

SHELL THEORY AND COLLECTIVE THEORY FOR THE Pb ISOTOPES. W. W. True (Indiana Univ., Bloomington). Phys. Rev. 101, 1342-9(1956) Feb. 15.

The 0.570-Mev gamma ray in Pb^{207} and the 0.803-Mev gamma ray in Pb^{205} are electric quadrupole transitions and have transition rates which are much too fast for neutron transitions. The surface tension parameters necessary to give the observed transition rates are determined by assuming that the collective motion of the core is weakly coupled to the external nucleons. The calculated surface tension parameters are 1100 Mev for Pb^{207} and 520 Mev for Pb^{205}. These two values are large compared to the hydrodynamic surface tension, as expected near closed shells, but the difference of a factor of 2 is unexpected. The quadrupole moment of Bi^{209} also indicates weak surface coupling. Also determined are the configurations which describe the low-lying energy levels of Pb^{204}, assuming short-range two-body forces. Reasonable agreement with experiment indicates that the shell model can account for the main portion of the level splitting. Many levels are predicted which have not been observed as yet. The 0.375-Mev gamma ray in Pb^{204} is anomalously slow even with weak surface coupling. A possible explanation for this slowdown is indicated by the configurations describing the initial and final states. In connection with the Pb^{204} problem, formulas are given for antisymmetrical wave functions in the j-j coupling scheme for three and four particles. (auth)

5950

ELASTIC SCATTERING OF 17-MEV PROTONS BY NUCLEI. I. E. Dayton and G. Schrank (Princeton Univ., N. J.). Phys. Rev. 101, 1358-67(1956) Feb. 15.

The absolute differential cross section for the elastic scattering of 17.00 ± 0.05 Mev (center of mass energy) protons has been measured for twelve elements: Be, C, Al, Fe, Co, Ni, Cu, Zn, Rh, Ag, Pt, and Au. Between 31 and 39 angles were taken for each element with a five-degree (or less) interval ranging from 15 to 172 degrees. The estimated standard deviation of each point is 2.5%. The scattered protons are detected by a NaI(Tl) crystal whose energy resolution is about 2.5%, with the result that in the majority of cases all inelastically scattered protons are rejected. (auth)

5951

ANGULAR CORRELATION OF GAMMA RADIATIONS FROM ORIENTED NUCLEI. P. S. Jastram, R. C Sapp, and J. G. Daunt (Ohio State Univ., Columbus). Phys. Rev. 101, 1381-8(1956) Feb. 15.

The angular correlation between the cascaded gamma rays following the decay of Co^{60} nuclei oriented at low temperatures has been determined. Comparison with the directional anisotropy of the individual gamma rays affords a test of the theory of Cox and Tolhoek largely independent of hyperfine interaction details and temperature determination. The theoretical predictions are confirmed. (auth)

5952

SPINS AND HYPERFINE STRUCTURE SEPARATIONS OF RADIOACTIVE Au^{198} AND Au^{199}. R. L. Christensen, D. R. Hamilton, A. Lemonick, F. M. Pipkin, J. B. Reynolds, and H. H. Stroke (Princeton Univ., N. J.). Phys. Rev. 101, 1389-95(1956) Feb. 15.

The focusing atomic beam apparatus has been used to

measure the spins and hyperfine structure separations of Au^{198}(2.7 days) and Au^{199}(3.15 days). The observed spins are 2 for Au^{198} and $3/2$ for Au^{199}. Observed $\Delta\nu$ for Au^{198} is 21,800 ± 150 Mc/sec, assuming μ_I to be positive, or 22,500 ± 150 Mc/sec, assuming μ_I to be negative. $\Delta\nu$ for Au^{199} is 11,110 ± 130 Mc/sec, assuming μ_I to be positive, or 11,180 ± 130 Mc/sec, assuming μ_I to be negative. The high $\Delta\nu$ for Au^{198} made it necessary to study that element by observation of multiple-quantum transitions. (auth)

5953

ANALYSIS OF THE SMALL-ANGLE ELASTIC SCATTERING OF HIGH-ENERGY PROTONS BY CARBON. Warren Heckrotte (Univ. of California, Berkeley). Phys. Rev. 101, 1406-9(1956) Feb. 15.

The usual treatment of the high-energy elastic scattering of protons by nuclei has been extended to include relativistic Coulomb corrections and a complex nuclear spin-orbit potential. With these additions it is possible to obtain a good fit of the experimental results on the polarization of high-energy protons scattered elastically by carbon for small scattering angles. In addition, it is possible to deduce the sign of the nuclear spin-orbit potential from the high-energy data alone. The significance of the imaginary spin-orbit potential is discussed. (auth)

5954

ON THE BINDING ENERGIES OF VERY LIGHT NUCLEI. Shota Suekane and Wataro Watari (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 14, 490-2(1955) Nov.

The ground state wave function for light nuclei is applied in determining the binding energy of H^3, He^3, and He^4. The appropriateness of this application is discussed, and the results are given. (D.E.B.)

5955

MEASUREMENT OF THE COEFFICIENTS OF INTERNAL CONVERSION OF γ-RAYS OF Sr^{87*}, In^{113*}, In^{115*}, AND V^{51*} ON THE ELECTRONS OF THE ATOMS. I. V. Estulin and E. M. Moiseeva (Moscow State Univ.). Soviet Phys. JETP 1, 463-7(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 541-6(1955) May. (In Russian).

The total coefficients of internal conversion of γ-rays of Sr^{87*}, In^{113*}, In^{115*}, and V^{51*} by atomic electrons are determined by the method of direct measurement of the number of electrons and γ-quanta which are emitted by the source. The corresponding values which have been found i.e., 0.26 ± 0.03, 0.39 ± 0.04, 0.9 ± 0.6 and $(3.1 \pm 0.2) \times 10^{-3}$ give basis for the conclusion that the isotopes Sr^{87*}, In^{113*}, and In^{115*} have electric 2^5 pole radiation transitions and that V^{51*} has an electric quadrupole radiation transition. (auth)

5956

DETERMINATION OF THE TRANSVERSE RELAXATION TIME OF NUCLEAR MAGNETIC MOMENTS. S. D. Gvozdover, N. M. Pomerantsov, and A. P. Poliakova (Moscow State Univ.). Soviet Phys. JETP 1, 471-4(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 584-8 (1955) May. (In Russian).

A new method is proposed for determining the transverse relaxation time from the shape of the magnetic resonance signals from atomic nuclei. In applying this method the inhomogeneity of the magnetic field over the volume of the sample can be measured simultaneously. The experiments indicated the usefulness of this method and agreed with the results of other authors, which were obtained by other methods. (auth)

Refer also to abstracts 6067, 6071, 6083, 6084, and 6085.

NUCLEAR REACTORS

5957 AD-65678

North Carolina State Coll., Raleigh.

THEORY OF THE REFLECTED REACTOR WITH ECCENTRIC CONTROL ROD (thesis). William Thompson Price. 1955. 55p.

Two-group neutron theory is applied to a reflected cylindrical nuclear reactor containing an eccentric control rod. The accurate solution for the critical condition is shown to involve the simultaneous solution of an infinite set of equations. The properties of these equations are discussed, and an approximate critical condition derived involving no more error than that inherent in two-group theory. An example calculation is made on the Raleigh Research Reactor. Close agreement of theory and experiment is found. (auth)

5958 AERE-M/R-1889

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FISSION-PRODUCT CONCENTRATIONS AND POISONING IN A HOMOGENEOUS REACTOR WITH CHEMICAL PROCESSING. W. H. L. Porter. Mar. 10, 1956. 51p.

Tables and graphs are presented giving the steady-state fission product concentrations and total capture cross sections in the core of a homogeneous reactor for various rates of chemical processing. The results are as general as possible, otherwise they are detailed for the specified system of a liquid metal homogeneous reactor based on U dissolved in Bi. Estimates are also given of the rate of production of inert gases in the main circuit. The transient condition when the reactor is first started up is not considered. (auth)

5959 AERE-T/M-131

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOLUTION OF THE TWO GROUP DIFFUSION EQUATIONS FOR DIMPLE. A. Hassitt. Feb. 1956. 6p.

The two velocity group neutron diffusion equations for a Dimple short core assembly have been solved by finite difference methods. The difference equations were solved on a Ferranti electronic computer. Complete flux plots for the fast and thermal groups are given. (auth)

5960 AERE-T/R-1904

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOLUTION OF THE MULTI-GROUP NEUTRON DIFFUSION EQUATIONS ON A DIGITAL COMPUTER. A. Hassitt. Mar. 1956. 16p.

A program has been devised, which will solve the two group diffusion equations for a homogeneous cylindrical reactor with reflectors, on a Ferranti Mark 1* computer. The differential equations are replaced by finite difference equations, which are solved by an iterative (extrapolated Liebmann) process. The program computes k and the neutron fluxes. A short account is given of the setting up of the finite difference equations, the theory of the iterative process, and the estimation of the errors due to the use of a finite mesh size. The computer takes 1 msec to add together two twelve decimal numbers, and 2 msec to multiply them together. The program takes about one hr to compute the fluxes (with 1% accuracy) and k, for a mesh of 700 points. (auth)

5961 CF-55-8-201

Oak Ridge School of Reactor Technology, Tenn.

AN EVALUATION OF HIGH FLUX NUCLEAR SYSTEMS FOR RESEARCH WITHIN THE LIMITATIONS OF THE ATOMS-FOR-PEACE PROGRAM. E. G. Silver, M. L. Batch, R. T. Breymeier, G. R. Dalton, J. M. Duncan, and F. C. Foushee. Aug. 1955. 196p.

A study is presented of possible reactor systems within the limitations of the Atoms-for-Peace Program using no more than 6 kg of U^{235} in enrichment of 20%. The basic investigation is by means of a two-group, two-region ORACLE calculation, but burnup, poison effects, and

operating times are also taken into account, and engineering and cost estimates for the most interesting cases are included. (auth)

5962 CRRP-624
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
MATERIAL BALANCE IN REACTORS WITH RECYCLED FUEL. Paper Prepared for the Reactor Core Conference at Chalk River, Ontario [on] January 9 to 12, 1956. G. C. Laurence. Jan. 4, 1956. 14p.

Studies are reported on the design of a thermal reactor using natural U and Pu. The Pu required would be recovered from the partly depleted U and returned to the reactor, thus extracting as much energy as possible from each pound of U. The reactor would be self-sufficient in producing all its own Pu requirements. Experience with an analog computer led to the conclusion that the instrument provides an ideal method for the purpose of obtaining rapid solutions for the design of a reactor with non-uniform lattice characteristics. A two group approximation was used in the calculations presented. Curves and data derived from nuclear cross sections and transposed into the form of a convenient symbolism for the use in calculating lattices are included. (C.H.)

5963 CRRP-629
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
A METHOD OF STUDYING MULTI-REGION REACTORS WITH AN ANALOG COMPUTER. Paper Prepared for the Reactor Core Conference, Chalk River, Ontario, January 9 to 12, 1956. R. M. Pearce. Jan. 5, 1956. 6p.

An electrical analog was developed at Chalk River for the study of reactors whose nuclear properties vary with radius. Several velocity groups can be used with the analog, though the geometry has been limited to spherical or cylindrical symmetry, or to slab reactors in which the nuclear properties vary in one direction only. The computer can solve finite-difference equations which are derived from the diffusion equations. The analog was used to compute the flux distribution and critical properties of a Pu–H_2O sphere with a H_2O reflector. (B.J.H.)

5964 DR-38
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
ATTAINABLE BURN-UP OF URANIUM WITH PLUTONIUM RECYCLING. (With Special Reference to the ANL 1000 MW Heavy Water Boiling Reactor of Geneva Paper P/495). W. B. Lewis. Feb. 3, 1956. 33p. (AECL-285).

A method of calculating the attainable burn-up of uranium is developed which readily takes into account any departures from the ideal of returning all the plutonium. The analysis is applicable only to the equilibrium condition when a steady state of recycling has been attained. It is shown that whereas an optimum assignment of parameters was made for starting up the ANL 1000-Mw D_2O boiling reactor with natural uranium, a greater burn-up of natural uranium would be attainable by reducing the resonance escape factor from 0.8364 to about 0.70. This, however, necessitates carrying a greater proportion of fissile material throughout the fuel cycle. Without this enrichment the attainable burnup is estimated as 30,000 megawatt days per ton, using the best data available on the properties of the plutonium isotopes. With enrichment and a reduction of the resonance escape factor, an attainable burn-up of 45,000 Mwd/t would be predicted. The methods used are given with a high degree of precision so that other cases may readily by analyzed. (auth)

5965 KAPL-1524
Knolls Atomic Power Lab., Schenectady, N. Y.
SAFEGUARDS ASPECTS OF REACTOR VESSEL DESIGN. W. E. Cooper and D. R. Miller. Mar. 30, 1956. 29p. Contract W-31-109-Eng-52. $0.25(OTS).

This paper deals with the problem of design for the high degree of structural reliability required in reactor vessels and with the theoretical evaluation of the mechanical effects of abnormal pressures due to chemical or nuclear incidents. The structural reliability required of reactor vessels exceeds that required of conventional pressure vessels. Furthermore, the existence of new problems or old problems of new significance must be recognized in the design stage of new high-performance reactor systems. Consequently, the extent of engineering effort expended in design and design evaluation must be substantially greater than is normally applied to design of conventional vessels. Similarly, the criteria for limitation of stresses, the quality of design details, and the degree of control of material and fabrication quality must be superior to practices normally used in design and fabrication of pressure vessels. (auth)

5966 NRL-4668
Naval Research Lab., Washington, D. C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART I. INSTRUMENTATION TESTS AT OAK RIDGE NATIONAL LABORATORY. C. W. Peters, F. E. Jablonski, and M. P. Young. Nov. 10, 1955. 18p.

The NRL reactor instrumentation channels with two compensated ionization chambers and a multiple plate safety chamber were taken to the Oak Ridge National Laboratory to be tested in the Bulk Shielding Reactor. The compensation and dynamic range characteristics and the sensitivities of the detectors were investigated. The performance of the logarithmic and linear recording channels under reactor operating conditions was observed. The equipment performed within the limits required for use in the NRL reactor. (auth)

5967 NRL-4729
Naval Research Lab., Washington, D. C. and Brookhaven National Lab., Upton, N. Y.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART II. REACTIVITY MEASUREMENTS ON A GRAPHITE AND WATER REFLECTED CORE. E. H. Bebbs, R. H. Vogt, and K. W. Downes. Mar. 27, 1956. 28p.

A series of experiments was performed jointly by NRL and BNL on a mock-up of the NRL Research Reactor at the critical facility of Brookhaven National Laboratory. Reactivity effects of fuel, temperature, a hole in the graphite reflector, control rods, and movement of the core were investigated as well as critical masses and relative neutron fluxes. The critical mass as a function of position was found as the core was gradually moved from a configuration in which three sides were graphite and three sides water reflected to one which was nearly completely water reflected. Fuel was added in increments of one or two fuel plates as the configuration was slowly changed and the reactivity effect of the fuel measured at each step. In this way the reactivity change with change in configuration was determined in terms of fuel. By an extrapolation of the results it is estimated that the reactivity of the fuel necessary to maintain criticality when the core is moved from the configuration in which three sides are graphite and three sides water reflected to one which is completely water reflected is 4.4%. (auth)

5968 RE-CR-964
Monsanto Chemical Co., Dayton, Ohio.
PRELIMINARY ENGINEERING STUDY OF ORGANIC

NUCLEAR REACTOR COOLANT-MODERATORS. Final Report. Malcolm McEwen. Mar. 31, 1956. 89p. Contract NObs-66067.

A test loop was designed, constructed, and installed in the Brookhaven National Laboratory reactor. It was operated for the purpose of making a preliminary engineering study of the feasibility of using organic materials as nuclear reactor coolant-moderators. This puspose was essentially satisfied on four selected organic materials: diphenyl; the tertiary eutectic mixture of diphenyl, m-terphenyl, and o-terphenyl; HB-40, a partially hydrogenated mixture of the terphenyl isomers; and monoisopropylbiphenyl. The factors investigated include: rate of decomposition; rate of gas generation; induced radioactivity; and effect of decomposition products on the operating characteristics of the system and on the engineering properties of the fluids under study. The range of conditions obtainable within the loop system were: heat fluxes from 8000 to 30,000 BTU/hr/sq ft; fluid temperatures up to 585°F; and fluid velocities of 3 to 11 ft/sec. Approximately 28% of the 70 lb of the fluid in the circulatory system was exposed to a fast flux of 1.6×10^{11} n/cm^2/sec. A summary of data obtained is presented. (auth)

5969 WAPD-SFR-Ph-124

[Westinghouse Electric Co. Atomic Power Div., Pittsburgh.]

FURTHER COMPARISON AND SIMPLIFICATION OF CELL THEORY AND EXACT SOLUTION FOR CONTROL RODS. L. Friedman. Nov. 15, 1955. 13p. $3.30(ph OTS); $2.40 (mf OTS).

The cell method of computing critical size for slab reactors was applied to a two-rod case and compared with the exact solution. The calculations are developed and the results plotted. Application of the cell method to more complex geometries is suggested by the very satisfactory agreement of the results. (D.E.B.)

5970 WAPD-SFR-Rs-444

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh]. REVIEW OF THERMAL DESIGN CRITERIA FOR PRESSURIZED WATER REACTORS AT 2000 psia. [Feb. 1956]. 18p. $3.30(ph OTS); $2.40(mf OTS).

A review of the existing thermal design criteria for pressurized water reactors was made and new thermal criteria may be summarized as follows: (1) local and bulk boiling is prohibited during steady state operation; (2) local heat flux at any point and time shall not exceed the burnout heat flux, reduced by a factor of safety. Steady-state local or bulk boiling was not recommended because information on corrosion and deposition effects is not available. (F.S.)

5971

SMALL GAS-CYCLE REACTOR OFFERS ECONOMIC PROMISE. Farrington Daniels (Univ. of Wisconsin, Madison). Nucleonics 14, No. 3, 34-41(1956) Mar.

The design, construction, and operation of a 20-Mw heat, He cooled reactor coupled with a 5-Mw electric gas turbine for power generation is presented. Operation at 225 psi He and 1350°F is proposed. Fuel rods would be 10%-enriched UC_2 (D.E.B.)

5972

PROGRESS ON MATERIALS—KEY TO GAS-CYCLE REACTOR POTENTIAL. Nucleonics 14, No. 3, 42-4(1956) Mar.

By enriching fuel and by increasing pressure of gas used as reactor coolant, heat transfer properties are improved, core and pressure vessel are made smaller, and cost is cut. Although steam cycle could be used, gas-cycle holds stronger cost promise. (auth)

5973

USING INTERMEDIATE EXPERIMENTS FOR REACTOR NUCLEAR DESIGN. W. H. McCorkle (Argonne National Lab., Lemont, Ill.). Nucleonics 14, No. 3, 54-6(1956) Mar.

Data for nuclear design of full-size reactors can be obtained by exponential-pile experiments. Since only a subcritical part of the core need be constructed, and there is no need for a reflector, shield, or cooling system, costs of the nuclear design of reactors are kept to a minimum. General principles and means of extrapolating the data to full-size reactors are described. (auth)

5974

CONDUCTING AN EXPONENTIAL EXPERIMENT WITH A NATURAL-U GRAPHITE LATTICE. H. Dopchie, F. Leonard, M. Neve de Mevergnies, and G. Tavernier (Centre d'Etudes pour les Applications de l'Energie Nucleaire, Brussels, Belgium). Nucleonics 14, No. 3, 57-60(1956) Mar.

Exponential pile experiments designed to check theoretical calculations an U-graphite lattice buckling are described. (D.E.B.)

5975

AUTOMATIC PERIOD CONTROL OF THE RALEIGH RESEARCH REACTOR. Harold A. Lamonds (North Carolina State Coll., Raleigh). Nucleonics 14, No. 3, 88, 90-4(1956) Mar.

A special electronic circuit permits the reactor to be brought automatically up to any desired level of operation on one of several preselected periods. When the desired power level has been reached, the automatic control system holds the level constant. This circuit, called the "automatic period control," is described. (auth)

5976

ELECTRONIC ANALOGS IN REACTOR DESIGN. J. A. Beutler and J. B. Roberts (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Chem. Eng. Progr. 52, 69F-74F (1956) Feb.

Applications of analog computers to chemical kinetics and reactor design problems are presented. (C.W.H.)

5977

LMFR FASCINATES ChE's. Chem. Eng. 63, No. 3, 114-15 (1956) Mar.

The feasibility, economic aspects, and design features of the Liquid Metal Fuel Reactor are reviewed. (C.W.H.)

5978

PROCESS HEAT FROM NUCLEAR REACTORS. Richard H. Graham (U. S. Atomic Energy Commission). Chem. Eng. 63, No. 3, 191-3(1956) Mar.

The application of fission heat to high-temperature reactions (e.g. coal gasification, nitrogen fixation, acetylene production, salt-water conversion, and hydrocyanic acid production) is discussed. Design problems of a process heat reactor are outlined. (C.W.H.)

5979

THE PRESSURIZED WATER REACTOR AS A SOURCE OF HEAT FOR STEAM PLANT. I. J. M. Kay and F. J. Hutchinson. Atomics 7, 43-8(1956) Feb.

A general discussion is given of the pressurized water reactor as a source of heat. The heat transfer characteristics of such a reactor are analyzed. The problems associated with the pressure vessel are briefly considered. (B.J.H.)

5980

REACTOR TRANSFER FUNCTIONS. F. E. O'Meara (Strategic Air Command, Omaha, Nebraska). Atomics 7, 49-51(1956) Feb.

In the design of reactor control systems it is often desirable to know the steady-state attenuation and phase shift of the reactor as a function of a sinusoidal variation of the reactivity. This information, combined with similar knowledge

of the detecting and control system characteristics, enables the designer easily and quickly to analyse the stability and accuracy of the whole reactor system. In addition, attenuation and phase-shift diagrams are quite useful in the synthesis of control systems since the effect of changing parameters is readily apparent. Finally, there is a correlation between the steady-state and transient response that may be evaluated by means of these attenuation and phase shift diagrams. (auth)

Refer also to abstracts 5628, 5654, 5796, 5797, 5798, 5799, 5801, 5803, 5821, 6007, 6031, and 6054.

NUCLEAR TRANSFORMATION

5981 AERE-Lib/Trans-646

THE FISSION OF URANIUM NUCLEI BY PROTONS OF ENERGY 460 MEV. N. S. Ivanova, N. A. Perfilov, and V. P. Shamov. Translated by U. B. Sykes from Doklady Akad. Nauk S.S.S.R. 103, 573-5(1955). 5p.

The probability of fission of U nuclei interaction with protons of 460 Mev was found to be 70 ± 18% in an observation of fission in high-sensitivity photographic emulsions. The fission cross section, depending on the flux of primary protons obtained by counting the number of primary protons of fission and number of U nuclei introduced obtained by the α disintegrations, was found to be 1.6×10^{-24} cm^2. (F.S.)

5982 AERE-Lib/Trans-653

ASYMMETRY OF THE RANGES OF FRAGMENTS IN THE FISSION OF HEAVY NUCLEI BY VERY FAST PARTICLES. V. P. Shamov and O. V. Lozhkin. Translated by V. Beak from Zhur. Eksptl'. Teoret. Fiz. 29, 286-91(1955). 9p.

Using data from an investigation of the fission of U, Bi and W nuclei under the action of protons with an energy of 660 Mev in P-9 fine-grained nuclear emulsion, the range distributions of fragments for different excitation energies of the nuclei undergoing fission were constructed. It was found that with increase of the excitation energy of the nucleus, there is an increase in the proportion of markedly asymmetrical fissions, this increase being considerably greater for Bi than for U. With excitation energy of the nucleus of ≥ 400 Mev the character of the fission is the same for U, Bi and W. An estimate was made of the region of excitation energy in which fission of the nuclei has the most symmetrical character — for uranium 60 to 100 Mev and for bismuth ~100 Mev. (auth)

5983

(γ,p + α) REACTIONS PRODUCED IN PHOTOGRAPHIC EMULSIONS. D. L. Livesey (Queen's Univ., Kingston, Ont., Canada). Can. J. Phys. 34, 216-22(1956) Feb.

Ilford C.2 plates were exposed to bremsstrahlung of maximum energy 70 Mev from the electron synchrotron at Queen's University, and 82 stars produced in the emulsion have been attributed to the reaction: $C^{12} + h\nu = H^1 + He^4 + Li^7 - 24.6$ Mev. The excitation function of the reaction shows a sharp drop near 40 Mev. and the integrated cross-section up to this limit has been estimated. In addition 23 stars have been identified as being due to the reaction: $N^{14} + h\nu = H^1 + He^4 + Be^9 - 18.2$ Mev. In both reactions the most probable mode of disintegration is by the initial emission of an alpha particle. The range measurements in the C^{12} stars have been used to derive an accurate range-energy relation for Li^7 ions in nuclear emulsion. (auth)

5984

INTERPRETATION OF THE DISINTEGRATIONS OF LIGHT ELEMENTS BY 0.9 MEV TRITONS. Denyse Magnac-Valette. Compt. rend. 242, 760-3(1956) Feb. 6. (In French).

An interpretation is given of the disintegration spectra of isotopes of Li, O, and C by 0.9-Mev tritons. The form of the continuum was calculated assuming the disintegration of the nuclei to be isotropic. (tr-auth)

5985

DISINTEGRATION OF Li, C, AND O ISOTOPES BY 0.9 MEV TRITONS. Robert Barjon, Denyse Magnac-Valette, and Jean Schmouker. Compt. rend. 242, 896-8(1956) Feb. 13. (In French).

A brief description is given of an experimental arrangement for using a very small quantity of tritium in order to obtain a beam of tritons from a 2-Mev Van de Graaff. This beam impinged upon several targets whose disintegration products are studied by the photographic method. (tr-auth)

5986

SHELL MODEL COUPLING AND ANGULAR DISTRIBUTION OF THE REACTION $C^{13}(p,\gamma)N^{14}$. O. Hittmair (Univ. of Sydney, Australia). Z. Naturforsch. 11a, 94-5(1956) Jan. (In German).

5987

(α,n) TYPE REACTIONS IN LIGHT NUCLEI. A. R. Quinton and W. T. Doyle (Yale Univ., New Haven, Conn.). Phys. Rev. 101, 669-72(1956) Jan. 15.

Two independent methods utilizing a recoil proton telescope and a neutron threshold detector have been used to study a series of (α,n) reactions. The following Q values have been observed: $B^{10}(\alpha,n)N^{13} - 3.85 \pm 0.3$, (-3.2 ± 0.3), -2.5 ± 0.3, -1.3 ± 0.3 Mev; $B^{11}(\alpha,n)N^{14} - 4.8 \pm 0.3$, -3.85 ± 0.3, -3.15 ± 0.3, -2.0 ± 0.3, 0.0 ± 0.3 Mev; $F^{19}(\alpha,n)Na^{22} - 5.0 \pm 0.2$, -4.25 ± 0.2, -3.8 ± 0.2, -3.15 ± 0.2, -2.45 ± 0.2, -2.0 ± 0.2 Mev; $P^{31}(\alpha,n)Cl^{34} - 5.7 \pm 0.2$ Mev. An excitation function has also been obtained for the 1.58-second β^+ activity in Cl^{34} with an observed threshold at -5.7 ± 0.3 Mev. (auth)

5988

ANGULAR DISTRIBUTION OF THE PROTONS FROM THE $O^{16}(d,p)O^{17}$ REACTION AS A FUNCTION OF THE BOMBARDING ENERGY. J. C. Grosskreutz (Univ. of Texas, Austin). Phys. Rev. 101, 706-9(1956) Jan. 15.

The angular distribution of the protons from the reaction $O^{16}(d,p)O^{17}$ leaving O^{17} in its ground and first excited states has been measured as a function of the deuteron bombarding energy. Deuterons of energy 2.51, 2.26, 2.01, 1.76, 1.60, 1.35, and 1.05 Mev were used to bombard thin ZnO targets. The resulting protons were detected at angles ranging from 5 to 160 degrees with respect to the deuteron beam. Detection was accomplished with CsI(Tl) phosphors on 6291 photomultipliers mounted as a unit in the vacuum housing of the reaction chamber. The characteristic forward stripping maxima are obtained in both reactions plus considerable yield in the backward direction, especially near resonances in the reaction. The effect of a resonance at 1.7 Mev is to flatten the distribution curves so as almost completely to mask their stripping character. Secondary maxima observed in the excited state distributions are interpreted as the result of nuclear interaction of the stripped proton with the residual nucleus. Coulomb effects are also observed as the deuteron energy is lowered. The stripping maxima are shifted to larger angles and the valleys become less pronounced. Absolute differential cross sections for the reactions are also given. (auth)

5989

ANGULAR DISTRIBUTION OF NEUTRONS FROM $O^{18}(p,n)F^{18}$. Hans Mark and Clark Goodman (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 101, 768-71(1956) Jan. 15.

The reaction $O^{18}(p,n)F^{18}$ has been studied using monoenergetic protons from the Rockefeller electrostatic generator. Resonances in the neutron yield in the forward direction are found at proton energies E_p = 2.657, 2.732, 2.778, 3.045, 3.170, 3.268, 3.386, 3.495, 3.600, and 3.755 Mev. The angular distribution of neutrons from this reaction at proton energies E_p = 3.045, 3.170, 3.268, and 3.386 Mev has been

measured with a proton recoil counter. The most probable values of the spins of the excited states in F^{19} corresponding to these resonances are $J = 3/2^{\pm}$, $1/2^{\pm}$, $3/2^{\pm}$, and $1/2^{\pm}$ respectively. (auth)

5990

ANGULAR DISTRIBUTION OF PROTON GROUPS FROM THE REACTION $F^{19}(d,p)F^{20}$. S. Takemoto, T. Dazai, R. Chiba, S. Suganomata, and S. Ito (Tohoku Univ., Sendia, Japan). Phys. Rev. 101, 772-4(1956) Jan. 15.

The angular distribution of proton groups from $F^{19}(d,p)F^{20}$ has been studied by means of nuclear emulsion with deuterons of energy 0.75 to 1.45 Mev. Distributions were found for each of three proton groups from fluorine, corresponding to the ground state (P_0), 0.65-Mev (P_1), and 0.99-Mev (P_3) + 1.06-Mev (P_4) levels in F^{20}, respectively. Group P_1 and P_3 + P_4 show stripping effect, and from a Butler analysis, l_n-values for these groups are 2 and 0, respectively. In the case of group P_0, the stripping effect is obscure. (auth)

5991

EMISSION OF PROMPT NEUTRONS FROM FISSION. R. B. Leachman (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 101, 1005-11(1956) Feb. 1.

An analysis of the total energies of the fragment pairs from fission is used with the mass equation of fission to estimate the distributions in the excitation energy of the fragments from spontaneous and neutron-induced fission of several nuclides. These excitations are used with simple neutron boil-off considerations to calculate the probabilities of emission of 0, 1, 2, 3··· prompt neutrons. The calculated results are in good agreement with recent measurements. The same excitation energy distributions and neutron boil-off considerations are used with an assumption of an isotropic angular relation between the fragments and the emitted neutrons to calculate the energy spectrum of neutrons from thermal and 3-Mev neutron-induced fission of U^{235}. For thermal-neutron fission, the calculated spectrum is in fair agreement with recent measurements. The calculations indicate little change in the spectrum for 3-Mev fission. The average energy of the prompt gamma rays is 3.8 Mev from this analysis. (auth)

5992

MULTIPLICITIES OF FISSION NEUTRONS. B. C. Diven, H. C. Martin, R. F. Taschek, and J. Terrell (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 101, 1012-15(1956) Feb. 1.

A large liquid scintillator with approximately 80% efficiency for detection of neutrons has been used to obtain data on numbers of neutrons emitted per fission for several fissioning nuclides. Reported here are the average number of neutrons per fission, $\bar{\nu}$, and the respective probabilities of 0, 1, 2, ··· neutrons per fission, for spontaneous fission of Pu^{240}, Cm^{244}, and Cf^{252}, and for fission induced in U^{233}, U^{235}, and Pu^{239} by 80-kev neutrons. The values of $\bar{\nu}$ for these cases are respectively, 2.257 ± 0.045, 2.810 ± 0.059, 3.869 ± 0.078, 2.585 ± 0.062, 2.47 ± 0.03, and 3.048 ± 0.079. The thermal neutron value for U^{235} (2.46 ± 0.03), obtained by other methods, was used here as a standard for calibrating the detector efficiency. The efficiency was also measured by another method, involving scattering neutrons into the scintillator, with results in good agreement. The probabilities of 0, 1, 2, ··· neutrons per fission approach closely a binomial type distribution, with the maximum number of neutrons equal to 5, 6, or 7, depending on $\bar{\nu}$. (auth)

5993

PROBABILITIES OF PROMPT-NEUTRON EMISSION FROM SPONTANEOUS FISSION. Donald A. Hicks, John Ise, Jr. and Robert V. Pyle (Univ. of California, Berkeley). Phys. Rev. 101, 1016-20(1956) Feb. 1.

The neutron number distributions from the spontaneous fission of seven isotopes have been measured by use of a cadmium-loaded liquid scintillation tank. The experimental distributions can be roughly approximated by binomial distributions. The average number of neutrons per spontaneous fission have been found to be 2.30 ± 0.19 for Pu^{236}, 2.33 ± 0.08 for Pu^{238}, 2.18 ± 0.09 for Pu^{242}, 2.65 ± 0.09 for Cm^{242}, 2.84 ± 0.09 for Cm^{244}, and 3.82 ± 0.12 for Cf^{252}, all based on 2.257 ± 0.046 for Pu^{240}. (auth)

5994

SPALLATION OF VANADIUM WITH 60-, 100-, 175-, AND 240-MEV PROTONS. Clarence G. Heininger and Edwin O. Wiig (Univ. of Rochester, N. Y.). Phys. Rev. 101, 1074-6 (1956) Feb. 1.

Cross sections have been determined for most of the observable radioactive nuclides produced in the bombardment of vanadium with 60-, 100-, 175-, and 240-Mev protons. The pattern of yields supports the cascade-evaporation theory. The number of nuclides produced in high yield is found to increase with increasing bombarding energy. (auth)

5995

ALPHA-PARTICLE BOMBARDMENT OF A^{36} AND A^{40}. R. B. Schwartz, J. W. Corbett, and W. W. Watson (Yale Univ., New Haven, Conn.). Phys. Rev. 101, 1370-2(1956) Feb. 15.

Gas targets (130-kev thick) of natural argon (99.6% A^{40}; 0.34% A^{36}) and of argon enriched in A^{36} (97.4% A^{36}; 2.5% A^{40}) have been bombarded with 7.4-Mev alpha particles from the Yale cyclotron. Protons and neutrons at 90° to the incident beam have been studied by means of 50μ Ilford C-2 emulsions, placed 16 cm from the target. The ground-state Q-value for the $A^{36}(\alpha,p)K^{39}$ reaction is −1.28 Mev, with excited states at 2.50 and 2.87 Mev. The ground state Q for $A^{40}(\alpha,p)K^{43}$ is −3.36 Mev, with excited states at 0.65 and 1.18 Mev. The cross sections for these two reactions, as well as for the $A^{40}(\alpha,n)Ca^{43}$ reaction, have been measured and are found to be in general agreement with the predictions of simple compound-nucleus theory. (auth)

5996

$Li^7(\alpha,n)B^{10}$ REACTION. A. B. Robbins (Yale Univ., New Haven, Conn.). Phys. Rev. 101, 1373-4(1956) Feb. 15.

The $Li^7(\alpha,n)B^{10}$ reaction has been investigated by two independent methods. In the first method, the energies of the neutron groups were measured with a proton recoil telescope using an integral range technique. In the second method, slow neutrons were observed at the threshold energies for each level with an enriched BF_3 counter. The combined results of the two methods give energy levels in B^{10} at excitation energies of 0.74, 1.31, and 1.72 ± 0.06 Mev, with a ground-state Q-value for the reaction of −2.82 ± 0.10 Mev. A comparative experiment with a Li^6 target was carried out so that positive assignment of the levels to B^{10} could be made. This work confirms the existence of a second excited state in B^{10} at 1.3-Mev excitation. The 1.3-Mev level had been observed in an early slow-neutron threshold experiment using the $Li^7(\alpha,n)B^{10}$ reaction, but it has not been found in other reactions leading to the same final nucleus. (auth)

5997

MAXIMUM YIELD OF PHOTONEUTRONS AND A NEW METHOD OF DETERMINING THE INTEGRAL CROSS-SECTION OF (γ,n) REACTIONS FOR HIGH ENERGY PHOTONS. V. I. Gol'danskii and V. A. Shkoda-Ul'ianov. Soviet Phys. JETP 1, 579-81(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 623-6(1955) May. (In Russian).

Refer also to abstracts 5862 and 5927.

PARTICLE ACCELERATORS

5998 CERN-PS/AED-4

European Council for Nuclear Research, Geneva. Proton Synchrotron Group.

MEASUREMENTS ON THE SITE. A. Decae. Dec. 1955. 29p.

An experimental section of the ring for the CERN proton-synchrotron was built on the site, and the behavior of the different ground layers under the stress of successive loads was studied. The results of these measurements are given in detail. Rock and ground surveys were continued. (B.J.H.)

5999 MURA-FTC-3

Midwestern Universities Research Assn., Urbana, Ill.

MARK V FFAG EXPANDED EQUATIONS OF MOTION. F. T. Cole. Jan. 19, 1956. 42p.

The expansions of the equations of motion of betatron oscillations in the Mark V alternating gradient accelerator in powers of the deviation from a circle and from an equilibrium orbit are discussed. It is found that in the case of large machines where $k \gg 1$ and $1/w \gg 1$ that comparatively simple equations for the combined radial and axial motion are quite accurate, while in the case of small machines, where these conditions do not hold, no such simple equations appear to exist. Coefficients in these equations are derived, and their magnitudes estimated and numerical examples given. (auth)

6000 MURA-LHJ/ss-1

Minnesota. Univ., Minneapolis and Midwestern Universities Research Assn., Urbana, Ill.

ADIABATIC DAMPING OF LARGE-AMPLITUDE PHASE OSCILLATIONS IN A LINEAR ACCELERATOR. Lawrence H. Johnston and Spencer Schuldt. [1956?]. 26p.

Formulas and tables are given for calculating the adiabatic damping of large-amplitude phase oscillations, due to changing the accelerating field, phase angle, and proton velocity. These are applied to determining the detailed energy distribution at the output of a conventional linear accelerator, in terms of input parameters. The possibility is investigated for accomplishing the normal function of a simple buncher by modifications of the initial parameters in the linear accelerator itself, with the hope of capturing 100% of the injected beam; this is shown to work in principle, but to require an excessively long accelerator in practice. The energy distribution in the output of a typical 50 Mev proton Linac using a constant accelerating field and a single-cavity buncher is calculated; 69% of all injected protons are stably accelerated, and of these 89% are ejected with energy spread less than $\pm$ ½%. Multiplying these factors, 61% of all injected protons will be accelerated to 50 Mev $\pm$ ½%; 47% will be within $\pm$ 0.3% in energy. This calculation takes account only of losses due to phase oscillations, in a perfectly aligned accelerator. (auth)

6001 MURA-TO-5

Midwestern Universities Research Assn., Urbana, Ill. and Illinois. Univ., Urbana.

MARK V WITH SCALLOPED MOTION IN THE AXIAL DIRECTION. Tihiro Ohkawa. [nd]. 7p.

The effect of a scalloped motion in the axial direction on the focusing properties of the Mark V FFAG synchrotron is discussed. Complete equations for the particle trajectories are developed. (B.J.H.)

6002

CONCERNING THE NECESSARY ACCURACY IN ADJUSTMENT FOR A STRONG-FOCUSING SYNCHROTRON. H. Humbach (Research Laboratory of Siemens-Schuckert-Werke, Erlangen, Germany). Z. angew. Phys. 7, 423-7(1955) Aug. (In German).

6003

HIGH VOLTAGE GENERATOR OF THE VAN DE GRAAFF TYPE WITH LIQUID CHARGE TRANSPORT. K. Janner, S. Magun, and E. Schopper (Physical Inst. of Stuttgart Univ. and Max Planck Inst. for the Physics of the Stratosphere, Hechingen, Germany). Z. angew. Phys. 7, 446-50(1955) Aug. (In German).

Refer also to abstract 6016.

RADIATION ABSORPTION AND SCATTERING

6004 HEPL-40

Stanford Univ., Calif. High-Energy Physics Lab.

INELASTIC AND ELASTIC SCATTERING OF 187-MEV ELECTRONS FROM SELECTED EVEN-EVEN NUCLEI. Richard H. Helm. Feb. 1956. 81p. Contract N6onr-25116, Linear Electron Accelerator Project and Contract AF18(600)-646, Research on Electron Scattering and Nuclear Structure [Project]. (OSR-TN-56-11).

A survey has been made of the differential scattering cross sections for 187-Mev electrons on the even-even nuclei $_{12}Mg^{24}$, $_{14}Si^{28}$, $_{16}S^{32}$, $_{18}A^{40}$, and $_{38}Sr^{88}$. It has been possible to separate the elastic scattering from the inelastic in all cases and to resolve the inelastic groups from specific nuclear levels for at least one level in all cases. A simple Born-approximation analysis of the elastic data yields values of the effective radii and surface thicknesses of the nuclear charge densities which are in substantial agreement with the results of Hahn, Ravenhall and Hofstadter; i.e., a radius parameter (for the heavier elements) of $c \cong 1.08\ A^{1/3} \times 10^{-13}$ cm (radius to half-maximum of the charge distribution) and a surface thickness of $t \cong 2.5 \times 10^{-13}$ cm (thickness from 10 to 90 percent of the maximum of the charge distribution). Phenomenological analysis of the inelastic scattering along the lines laid down by Schiff yields some tentative multipolarity assignments, and application of some results of Ravenhall yields estimates of partial level widths; for the E2 transitions these correspond to lifetimes of $\sim 19 \times 10^{-13}$ sec to $\sim 1.4 \times 10^{-13}$ sec. The observed strengths of the transitions are compared to those predicted by Weisskopf theory. (auth)

6005 NP-5889

Saint Louis Univ.

SLOW NEUTRON SCATTERING BY POLYCRYSTALLINE AND NON-CRYSTALLINE SUBSTANCE. Technical Report No. 2 [for] November 1, 1954 to December 15, 1955. Robert M. Delaney, Paul J. Persiani, and A. H. Weber. Jan. 15, 1956. 70p. Project title: NEUTRON DIFFRACTION STUDY OF THE STRUCTURE OF GLASSES. Contracts DA-23-072-ORD-473 and DA-23-072-ORD-593.

Radial atomic density distributions in polycrystalline and non-crystalline substances are derived for differential and total cross section type experiments. The analysis is based on the single-oscillator, one phonon theory of R. Weinstock. The expressions obtained are compared with those used in x-ray analysis. Isotope and spin effects are neglected. Analysis of experimental results is in progress. (auth)

6006 PWAC-137

Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.

THE THERMAL NEUTRON VELOCITY DISTRIBUTION IN MONATOMIC MEDIA. John W. Niestlie, Jr. and Arthur I. Berman. Jan. 13, 1956. 10p.

The hardening of the thermal neutron spectrum with

respect to the Maxwellian distribution has been calculated for an infinite medium of constant scattering cross section in which small amounts of material of high absorption cross section are introduced. Scattering probabilities derived by Wigner and Wilkins for monatomic media whose atoms are in classical motion were used in the formulation. The integral neutron conservation equation, obtained by cutting off the distribution at an arbitrary high velocity and introducing a source of neutrons degraded from an external constant flux, was solved by an iterative method with an IBM 701 computer. (auth)

6007

ON THE SCATTERING OF A NEUTRON BY A HYDROGEN ATOM. Paul N. Roussopoulos. Compt. rend. 242, 473-4 (1956) Jan. 23. (In French).

It is suggested that the presence of the orbital electron in the H atom modifies the process of neutron scattering by H. Calculations are made on the importance of this effect. (B.J.H.)

6008

THE DISCONTINUITIES OF L_I AND L_{II} ABSORPTION IN Au METAL AND Au–Pd AND Au–Ag ALLOYS. Chintamani Mande. Compt. rend. 242, 755-8(1956) Feb. 6. (In French).

In continuing work on the L absorption spectra of Au in the pure metal and in Au–Pd and Au–Ag alloys, the forms of the L_I and L_{II} discontinuities have been studied. It is found that L_I has 2 discontinuities and that the form of L_{II} resembles that of L_{III}. The differences between the forms of the discontinuities for the pure metal and for the alloys are shown. (tr-auth)

6009

RANGE-ENERGY RELATIONS FOR LIGHT NUCLEI IN AIR AND NUCLEAR EMULSION. D. L. Livesey (Queen's Univ., Kingston, Ont., Canada). Can. J. Phys. 34, 203-15(1956) Feb.

An empirical method has been developed for estimating the effective charge of ions between Z = 3 and Z = 10 over a wide range of velocities in air and nuclear emulsion. The results are used in conjunction with a power-law function for the variation of stopping-power with velocity to derive range-energy relations for these ions. The curves are compared with all available experimental data, and agreement within the limits of experimental error is obtained in all cases except those of fluorine and neon ions in air. (auth)

6010

THE CAPTURE CENTERS AND KINETICS OF POST LUMINESCENCE IN AMMONIUM-HALIDE PHOSPHORS. L. Ya. Uibo, and I. V. Yaek (Tartu State Univ.) Doklady Akad. Nauk S.S.S.R. 105, 1212-14(1955) Dec. 21. (In Russian).

The capture levels and kinetics of post luminescence in $NH_4Cl{\cdot}TlCl$, and $NH_4Br{\cdot}TlBr$ phosphors were investigated by a thermal luminescence method. Curve peaks show the complicated character of mixed crystal thermoluminescence. (R.V.J.)

6011

ON THE VARIATION OF p-p SCATTERING CROSS SECTION WITH ENERGY. C. C. Banerjee (Indian Assoc. for the Cultivation of Science, Calcutta). Indian J. Phys. 29, 380-3(1955) Aug.

An attempt is made to find an empirical relation between the differential proton-proton scattering cross section and the energy of the system. The relation proposed agrees fairly with the experimental data at high and low energies. (auth)

6012

PROTON RELAXATION TIMES IN H_2O–D_2O MIXTURES. W. A. Anderson and J. T. Arnold (CERN, Geneva, Switzerland). Phys. Rev. 101, 511-12(1956) Jan. 15.

The relaxation time, T_1, of protons in H_2O–D_2O mixtures has been measured and found to depend strongly upon the relative proton concentration. This dependence supports the assumption of Bloembergen, Purcell, and Pound that the main relaxation mechanism in water is a nuclear dipole interaction. (auth)

6013

NUCLEAR ELASTIC SCATTERING OF PHOTONS. E. G. Fuller and Evans Hayward (National Bureau of Standards, Washington, D. C.). Phys. Rev. 101, 692-700(1956) Jan. 15.

A NaI(Tl) scintillation spectrometer, biased to detect only photons in the upper energy tip of a betatron-produced bremsstrahlung spectrum, is used to measure the differential nuclear elastic scattering cross section at 120 degrees as a function of photon energy from 4 to 40 Mev. The targets ranged in Z from Na to U. Total cross sections are calculated by assuming a dipole angular distribution. The scattering cross sections tend to exhibit two maxima, one below the particle threshold that corresponds to the scattering by separate levels, and one that follows the giant resonance for photon absorption. Both the maximum cross section and the energy of the giant resonance vary smoothly with A from Na to U and are roughly proportional to $(NZ/A)^2$ and $A^{-1/3}$, respectively. The dipole dispersion relation is used to compare the scattering data with the neutron yield data in the giant resonance region. (auth)

6014

SCATTERING OF POLARIZED NEUTRONS FROM PROTONS AT 350 MEV. R. T. Siegel, A. J. Hartzler, and W. A. Love (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 101, 838-42(1956) Jan. 15.

Asymmetries in neutron-proton scattering have been measured at 350 Mev with a 16% polarized neutron beam. Recoil protons were detected at angles between 10 and 65° in the laboratory, with asymmetries measured to about ½% accuracy. When compared with the results of p–n scattering with polarized protons, the present experiment gives information on the spin dependence of the scattering matrix. (auth)

6015

PROTON-PROTON SCATTERING FROM 40 TO 95 MEV. U. E. Kruse, J. M. Teem, and N. F. Ramsey (Harvard Univ., Cambridge). Phys. Rev. 101, 1079-85(1956) Feb. 1. (cf. NSA 8-5050).

Proton-proton scattering experiments between 40 and 95 Mev are described. Two methods for observing the proton-proton differential scattering cross section were employed; in the first, hydrocarbon scatterers were used to obtain the angular distribution at 95 Mev and to obtain the cross section at 90° as a function of energy. In the second, liquid hydrogen was used for the target and the angular distribution at 95 and 70 Mev was obtained to angles of 25°. Throughout, a Faraday cup was used to monitor the incident beam. The cross section rises smoothly from 4.65 ± 0.25 mb at 95 Mev to 11.4 ± 0.8 mb at 41 Mev. At 95 Mev the cross section shows a slight increase to smaller angles; the ratio between 40° and 90° is 1.06 ± 0.03. (auth)

6016

ANGULAR DISTRIBUTION OF BETATRON TARGET RADIATION. A. Sirlin (Univ. of California, Los Angeles). Phys. Rev. 101, 1219-26(1956) Feb. 15.

An attempt is made to combine the bremsstrahlung intrinsic energy-angle distribution for radiated photons with Moliere's multiple-scattering theory for the incident electrons. The angular distribution of betatron radiation is essentially characterized by a function $I(\theta)$, which is given as a series in inverse powers of Moliere's parameter B. The first term of this expansion, which is dominant for small angles, is equivalent to a combination theory developed on the basis of a Gaussian approximation for multiple scat-

tering. This term is worked out exactly and its final expression may be compared with previous theories which depend upon mathematical approximations. The term of order B^{-1} becomes important for larger angles and gives the transition to the contribution of single-scattered electrons. Expressions for the forward radiation and energy-angle distribution are given. The angular distribution predicted by these results was found to be in good agreement with an experiment performed by Lanzl and Hanson. (auth)

6017

THE COHERENT SCATTERING OF γ-RAYS BY K ELECTRONS IN HEAVY ATOMS. III. THE SCATTERING OF 0.64 mc^2 γ-RAYS IN MERCURY. G. E. Brown (Univ. of Birmingham, England) and D. F. Mayers (Univ. of Cambridge, England). Proc. Roy. Soc. (London) A234, 387-90(1956) Feb. 21.

The results of calculations for the coherent scattering of γ rays of energy $0.64mc^2$ are given in the form of scattering amplitudes as functions of angle. Values for the photoelectric effect at $0.32mc^2$ and $0.64mc^2$ are reported. (auth)

6018

CAPTURE OF ELECTRONS AND IONIZATION BY PROTONS IN HYDROGEN. Ya. [Ia.] M. Fogel, L. I. Krupnik, and B. G. Safronov (Physico-Technical Inst., Academy of Sciences, Ukrainian). Soviet Phys. JETP 1, 415-25(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 589-602(1955) May. (In Russian).

The effective cross section of single electron capture and ionization in hydrogen by means of protons of energy in the region of 12.3 to 36.7 kev was measured by means of an improved method of collecting slow particles on the electrode of a plane parallel condenser. The results obtained are compared with data obtained by other workers as well as with theoretical calculations. When protons pass through hydrogen, negative hydrogen ions are found in the proton beam. It is shown that at low gas pressures the appearance of negative hydrogen ions is connected with the process of double electron capture from hydrogen by the protons. Preliminary measurements of the effective cross section for this process with protons of energy 13, 21, and 31.4 kev show that this phenomenon cannot distort the measurements of the effective cross section of single electron capture as measured. (auth)

Refer also to abstracts 5788, 5871, 5872, 5873, 5882, 5894, 5896, 5900, 5915, 5923, 5926, 5950, 5953, 5985, 6066, 6073, 6080, and 6088.

RADIATION EFFECTS

6019 CF-56-6-148

Oak Ridge National Lab., Tenn.

IRRADIATION EXPERIMENT ON ALUMINUM FUEL PLATES CONTAINING A 48 w/o URANIUM −52 w/o ALUMINUM ALLOY, WITH A 20% ENRICHMENT IN THE U-235 ISOTOPE. R. J. Beaver. June 29, 1956. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

An evaluation was made of the irradiation behavior of Al fuel elements, containing an Al−U alloy concentrated in U at 48 wt. % and 20% enriched. (auth)

6020 NP-5979

Duke Univ., Durham, N. C.

QUARTERLY PROGRESS REPORT OF DUKE MICROWAVE LABORATORY [FOR] FEBRUARY 1, 1956−MAY 1, 1956. Report No. 13. 43p. Project R-357-10-6. Contract AF18(600)-497.

Abstracts of the work in progress in sub-millimeter wave development; electron-spin resonance in x-irradiated hormones, vitamins, proteins, sugars, cellulose fibers, nucleic acids, and amino acids; and the effects of temperature and isomeric structure on the electron-spin resonance of x-irradiated amino acids are given. Two technical reports, effects of x-irradiation upon some organic substances in the solid state (simple alcohols, amines, amides, and mercaptans) and millimeter wave spectrum, molecular structure, and dipole moment of hydrogen selenide are included. (F.S.)

6021

ON THE NATURE OF THERMAL SPIKES. Charles W. Tucker, Jr. and Peter Senio (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Appl. Phys. 27, 207-9(1956) Mar.

Theoretical calculations suggest that the duration (10^{-11} sec) and smallest dimension (20 atom diameters) of thermal spikes in metals undergoing irradiation may be too small to permit the thermal nucleation and growth of crystals of a second phase even though the average "temperature" of the spike may be above the melting point. Experiments have been performed which show that even the very energetic fission thermal spikes are too rapid and small to permit the nucleation and growth of a second phase in uranium metal containing 2 atomic % chromium. It is suggested that the terms "heated" and "melted" are not strictly appropriate to thermal spikes. Rather the region of a thermal spike should be regarded as a highly disturbed zone in which atomic interchange can occur, but which quickly returns to the structure and orientation of the surrounding crystal with a distribution of interstitials and vacancies which may then interact with each other or with other defects possibly present in the crystal. (auth)

6022

RADIATION-INDUCED COLORING OF SODIUM AZIDE. Hyman Rosenwasser and Russell W. Dreyfus (Picatinny Arsenal, Dover, N. J.) and Paul W. Levy (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 24, 184-90(1956) Feb.

The coloring of sodium azide (NaN_3) by gamma-ray and fast and slow neutron bombardment has been studied by reflection measurements. Gamma rays alone produce a broad absorption band at 3600 A, which is little affected by heating at 90°C, and poorly-defined bands at 6600 and 7600 A which decay completely at room temperature. Fast neutron irradiation at room temperature, or slow neutron irradiation at 100°C, as well as slow neutron irradiation at room temperature and subsequent heating at approximately 90°C give rise to a band at 6000 A. This also appears when material, which has been subjected to γ irradiation, is heated at higher temperatures. When heated near the decomposition temperature, the spectra of NaN_3 crystals which have been subjected to any of the above forms of irradiation are similar. At this temperature another band appears at 2800 A. Heat treatment alone colors the unirradiated material primarily near 3600 A, but much less intensely than in irradiated crystals. It appears that some of the observed bands are connected with the decomposition of this compound, brought about either by irradiation or thermal treatment. (auth)

6023

EFFECTS OF RADIATION ON PHYSICAL PROPERTIES AND STRUCTURE OF SOLID BODIES. A. I. Zakharov. Uspekhi Fiz. Nauk 57, 525-76(1955) Dec. (In Russian).

A review of theoretical concepts and up-to-date experimental data of radiation effects on solids are given. (R.V.J.)

6024

NEUTRON BOMBARDMENT OF COUNTING DIAMONDS. A. H. B. Benny and F. C. Champion (King's Coll., London). Proc. Roy. Soc. (London) A234, 432-40(1956) Feb. 21.

Several counting diamonds were exposed to nuclear radiations in a nuclear reactor. The counting efficiency is reduced approximately in proportion to the radiation dosage; a corresponding increase occurs in the optical absorption.

Annealing at red heat leads only to partial recovery in both counting and optical transparency. Examination was also made of the effect of neutron bombardment on pulse-height distribution when recording α particles of homogeneous energy by a diamond counter, used as a solid ionization chamber. The results are interpreted in terms of intrinsic charge traps and of additional charge traps produced by the neutrons. The layered crystal texture disclosed agrees with that already proposed from an interferometric investigation of etch. (auth)

6025

STRUCTURE SENSITIVITY OF THE X-RAY COLORATION OF NaCl CRYSTALS. R. B. Gordon and A. S. Nowick (Yale Univ., New Haven, Conn.). Phys. Rev. 101, 977-83(1956) Feb. 1.

Room temperature measurements of the rate of coloring of NaCl crystals by x rays at different depths below the irradiated surface and for different states of deformation and heat treatment are reported. From the results, it is concluded that two mechanisms of coloring operate in these crystals. The first, or "rapid-type" coloring, approaches a saturation density of F centers of the order of $10^{17}/cm^3$, and appears to result from the generation of color centers from vacancies already present in the unirradiated crystal. The second, or "slow-type" coloring, takes place at a constant rate until F centers in excess of $10^{18}/cm^3$ are formed. This type of coloring, which is usually observed only near the irradiated surface, is due to the generation of F centers at dislocations, and is responsible for the hardness and density changes produced by the x rays. Rapid-type coloring is found to occur at essentially the same rate in deformed crystals and in carefully annealed crystals; recovery at low temperatures after deformation, however, decreases the colorability. These results indicate that the principal effects of deformation and heat treatment on colorability may be related to the state of dispersion of impurities. (auth)

6026

EFFECT OF NEUTRON BOMBARDMENT ON A ZINC SULFIDE PHOSPHOR. Alan W. Smith (National Carbon Research Labs., Cleveland, Ohio). Phys. Rev. 101, 1263(1956) Feb. 15. (cf. NSA 8-4437).

It was previously shown that neutron bombardment produced new traps in a zinc sulfide phosphor. These were interpreted as electron traps on the model of Klasen and Schoen. The new model proposed by Lambe and Klick for cadmium sulfide may be used here. This new model gives a better interpretation of the dielectric constant changes observed on neutron-irradiated samples, and is consistent with the rest of the data. (auth)

6027

RADIATION DAMAGE IN VITREOUS SILICA: ANNEALING OF THE DENSITY CHANGES. W. Primak and H. Szymanski (Argonne National Lab., Lemont, Ill.). Phys. Rev. 101, 1268-71(1956) Feb. 15.

The kinetics of annealing of the nuclear reactor radiation-induced change in density of a sample of irradiated vitreous silica was studied by means of a series of isothermal annealings performed at various temperatures. The property change was found to anneal gradually over a broad range of temperatures suggesting a range of activation energies for annealing. (auth)

6028

USE OF THERMOCOUPLES IN A RADIATION FIELD. Hubert P. Yockey (Oak Ridge National Lab., Tenn.). Phys. Rev. 101, 1426(1956) Feb. 15.

The radiation damage effects on an iron–constantan thermocouple are briefly discussed. It is concluded that such thermocouples give satisfactory temperature indication for most radiation field applications. (B.J.H.)

Refer also to abstracts 5889 and 5932.

RADIOACTIVITY

6029 ISC-665

Ames Lab., Ames, Iowa.

THE NUCLEAR CHEMISTRY OF ANTIMONY AND TELLURIUM. Marion C. Day, Jr. and Adolf F. Voight. Dec. 1955. Contract W-7405-eng-82. $0.40(OTS).

Decay schemes, spin and parity assignments, and β and γ energies of Sb^{127}, Sb^{129}, Te^{127}, and Te^{129} are reported. (C.W.H.)

6030 NARF-55-34T(Rev.A)

CONVAIR, Fort Worth, Tex.

PRELIMINARY EVALUATION OF ENVIRONMENTAL RADIOACTIVITY IN THE NTA TEST AREA AND FLIGHT CORRIDOR. R. F. Shockley. Jan. 15, 1956. 37p. Contract AF33(038)-21117. (3-R-72R(Rev.A)).

Background levels of environmental radioactivity have been established at sampling points in Texas and New Mexico. Air, water, soil, and vegetation samples were checked. The established levels do not differ significantly from those reported in other sections of the country. Cross checks of duplicate samples were made by Convair and other facilities. These checks helped to eliminate many of the errors inherent with the processing and counting methods. The extent of agreement between the checking facilities was very good. Samples were taken before, during and after the spring 1955 Nevada Weapons Tests. Those samples taken prior to the tests were used as a control group. Comparison of the other samples to this group indicated an increase in many cases. The increase is attributed to "fall-out" from the weapons tests. (auth)

6031 NP-5887

Mine Safety Appliances Co., Callery, Penna.

BEHAVIOR OF Na–24 AND Mo–99 AS WATER CONTAMINANTS LEAKING FROM A 550 F, 2000 PSIG SYSTEM. Technical Report No. 46. R. J. Campana and J. W. Mausteller. Feb. 15, 1956. 22p. Contract NObs-65426.

The behavior of Na^{24} and Mo^{99} in water leaking from a 550°F, 200 psig system into a 4000 cu ft enclosure has been studied over a range of 1 to 100 lph leak rates. Leakage sites used were 7 and 10 mil holes in lagged and bare pipe, gaskets between flanges, valve glands and a valve seat. Air activities always reached a maximum level in ~5 hr of leakage, with 85% of the activity carried in dry particles of 0.4 to 0.7 microns, and essentially none associated with water. The less soluble Mo^{99} gave air activities ~10 times higher than Na^{24}. Na^{24} air activities were lower than Mo^{99} activities. Ranges were < 0.5 to 90 $\mu\mu c$ Na^{24}/ml with 0.5 μc/ml concentration in the leaking water. Mo^{99} air activities ranged from 3 to 800 $\mu\mu c$/ml at the same water activity. The NBS maximum permissible activity level for Na^{24} (2 $\mu\mu c$/ml) was generally exceeded but that for Mo^{99} (2000 $\mu\mu c$/ml) was never exceeded. Insulation or valve packing attenuated the air activities associated with bare leaks by factors of 30 to 5, and extended surfaces at the leak sites also resulted in reduced air activities. Relative humidity had no discernible effect on air activity until 100% was exceeded, when precipitated moisture swept activity from the air. Fall-out coefficients after leakage varied from 0.1 to 0.8/hr. (auth)

6032 NRL-4760

Naval Research Lab., Washington, D. C.

RADIOACTIVITY OF THE AIR. I. H. Blifford, Jr., H.

Friedman, L. B. Lockhart, Jr., and R. A. Baus. Feb. 21, 1955. 37p. Project No. NR-612-130.

This report supersedes NRL-4509.

An analysis of some of the results obtained from NRL stations for the detection and collection of atmosphere radiation is presented. Data show diurnal and seasonal variations in natural radioactivity. Atmospheric activity is not uniform even after an atomic explosion but clouds of fission activity follow fairly restricted paths. (F.S.)

6033

SOME ASPECTS OF THE USE OF FISSION PRODUCT CAESIUM 137 IN TELECURIE UNITS. J. H. Mellink. J. belge radiol. 38, No. 4, 662-79(1955). (In English).

6034

MEASUREMENT OF THE K FLUORESCENCE YIELD AND A STUDY OF THE K AUGER RAYS OF Tc^{99}(6.04h) AND In^{115}(4.5h). Jeanne Laberrigue-Frolow and Pierre Radvanyi. Compt. rend. 242, 901-4(1956) Feb. 13. (In French).

The β-spectrometer study of the K Auger lines of Tc^{99} and In^{115} has given, by comparison with the K conversion lines, a determination of the fluorescence yield of the K shell. The results give $R_k = 0.70 \pm 0.03$ for Tc^{99} and $R_k = 0.87 \pm 0.03$ for In^{115}. The partial intensities of the KLL, KLX, and KXY Auger groups are 1, 0.48 ± 0.06, and 0.050 ± 0.010 for Tc^{99}, and 1, 0.42 ± 0.10, and 0.05 ± 0.02 for In^{115}. (tr-auth)

6035

β-RAY SPECTRUM OF RaE. Hisao Takebe, Seitaro Nakamura (Univ. of Tokyo), and Mitsuo Taketani (Rikkyo Univ., Tokyo). Progr. Theoret Phys. (Japan) 14, 317-36 (1955) Oct.

It is shown that the beta-ray spectrum of RaE can be explained in the Fermi theory in terms of the scalar plus tensor interaction for the selection rule, $\Delta J = \pm 1$, yes. In this attempt, the simultaneous contribution to the electron wave function of the finite de Broglie wave length effect and the finite nuclear radius effect is reasonably taken into account. As far as the present calculation is concerned, the relative sign of the weight of the scalar and tensor interaction can not be determined. (auth)

6036

SARGENT DIAGRAM AND COMPARATIVE HALF-LIVES FOR K-ELECTRON CAPTURE TRANSITIONS OF ODD NUCLIDES (WITH $Z \leq 60$). L. S. Cheng (Ohio State Univ., Columbus). Revs. Mod. Phys. 28, 45-7(1956) Jan.

A modified Sargent diagram of K-electron capture transitions of odd nuclides with $Z \leq 60$ shows an allowed transition band with superallowed transitions well above the first-forbidden transitions below it. Correspondingly the histogram of log ft values of these transitions shows a peak in the range of 5 to 6. (auth)

6037

DISINTEGRATION OF Te^{129}. William E. Graves and Allan C. G. Mitchell (Indiana Univ., Bloomington). Phys. Rev. 101, 701-5(1956) Jan. 15.

The disintegration of Te^{129} has been investigated with the help of a magnetic lens spectrometer, permanent field spectrometer with photographic recording, and scintillation counters. The half lives of the isomeric states in the parent were found to be 41 days and 74 minutes, respectively. The 74-minute state decays to I^{129} with the emission of beta-ray groups whose end-point energies and relative abundances are 1.453 Mev (71%), 0.989 Mev (15%), 0.69 Mev (4%), and 0.29 Mev (10%). Gamma rays of 0.027, 0.21, 0.475, 0.72, and 1.12 Mev were found. The 41-day state decays, for the most part, to the 74-minute state of Te^{129} with the emission of a highly internally converted gamma ray of energy 106.3 ± 0.1 kev for which the K/L ratio is unity. A beta-ray transition, of low intensity, from the 41-day state of Te^{129} to the ground state of the product is postulated. Gamma-gamma and beta-gamma coincidence experiments using scintillation spectrometers served to indicate the probable level scheme of I^{129}. A discussion of the disintegration scheme is given suggesting probable spins and parities of the levels. (auth)

6038

ALPHA-GAMMA ANGULAR CORRELATION IN Bi^{212}(ThC). John W. Horton (Palmer Lab., Princeton, N. J.). Phys. Rev. 101, 717-25(1956) Jan. 15.

The $\alpha-\gamma$ angular correlation function, $W(\theta)$, of the cascade $Bi^{212}(ThC) \rightarrow Tl^{208*} \rightarrow Tl^{208}(ThC'')$ was determined by experiment to be consistent with a predicted law of the form $W(\theta) = 1 + A\cos^2\theta$. The ratio $W(90°)/W(180°)$ was measured to be 1.2993, ±0.0095 due to statistics, and ±0.010 due to experimental corrections. Comparison of this result with predictions of $\alpha-\gamma$ angular correlation theory shows that Bi^{212} cannot have zero spin. Of fifty-four possibilities considered, it is shown that the following spin and parity assignments are most consistent with presently available experimental and theoretical evidence from several sources: the ground state of Bi^{212} is 1(−), the 40-kev state of Tl^{208} is 4(+), and the ground state of Tl^{208} is 5(+). These assignments determine the orbital momenta of α particles emitted in the decay of Bi^{212} to be a mixture of 3 and 5 units for the transition to the 40-kev state of Tl^{208} and to be 5 units for the transition to the ground state of Tl^{208}. Using these values of orbital momenta in the Gamow theory, and in the Weisskopf-Devaney theory of α fine-structure, the theoretical ratios of decay probabilities for the two groups, λ(40 kev)/λ(0,) are found to be in good agreement (10 to 50%) with the observed value. This agreement affords, in the case of Bi^{212}, an explanation for the prohibited decay to the ground state relative to the first excited state found for many non-even-even nuclei by Perlman, Ghiorso, and Seaborg. Since the emission of the α particle with five units of orbital momentum hinders the decay $Bi^{212} \rightarrow Tl^{208}$ (ground state) by a factor of 16, this helps to explain the unusual size of the "departure factor" (1000) given to this decay by Perlman et al. (auth)

6039

CONVERSION ELECTRON SPECTRA OF Cm^{242} AND Cm^{244}. W. G. Smith and J. M. Hollander (Univ. of California, Berkeley). Phys. Rev. 101, 746-50(1956) Jan. 15.

The conversion electron spectra of Cm^{242} and Cm^{244} have been studied by means of two 180° photographic recording beta-ray spectrographs. Conversion coefficient ratios in the L and M subshells have been measured for several E2 transitions in the decay of these nuclides, and the values so obtained compared with theoretical ratios. Accurate energy determinations of the first three excited states in Pu^{238} are reported, and the validity of the Bohr-Mottelson rotational energy formula, including the vibration-rotation interaction term to describe these states, is discussed. A more accurate value is reported for the energy of the first excited state in Pu^{240}. The decay of I^{131} is discussed briefly. (auth)

6040

RADIATIONS FROM FOUR RADIOACTIVE ISOTOPES OF PLATINUM. V. R. Potnis, C. E. Mandeville, and J. S. Burlew (Bartol Research Foundation of The Franklin Inst., Swarthmore, Penna.). Phys. Rev. 101, 753-8(1956) Jan. 15.

The gamma radiations of the 18-hr Pt^{197} have been examined with scintillation counting methods and have been found to consist of 77- and 191-kev quanta in coincidence and a 279-kev gamma ray which is noncoincident with other gamma rays. Beta-gamma coincidence studies have been performed and values of log ft have been obtained for the three beta-ray spectra of Pt^{197}. The radiations of Pt^{195m} include gamma rays of energies 31, 99, and 130 kev. The latter gamma ray is not to be confused with the highly converted one emitted in the 3.8-day isomeric transition and is the cross over of the 31-kev−99-kev cascade. Pt^{193m}

emits a gamma ray of energy 130 kev. No quantum radiations of higher energies were detectable. Some coincidence measurements have been performed on the complex gamma-ray spectrum of Pt^{191}. (auth)

6041

BETA DECAY OF Ne^{23}. H. J. Gerber, M. Garcia Muñoz, and D. Maeder (Eidgenössische Technische Hochschule, Zürich, Switzerland). Phys. Rev. 101, 774-5(1956) Jan. 15.

The disintegration of Ne^{23} was formerly considered to contribute to the few examples of superallowed transitions in negative beta decay. This decay has been reinvestigated using scintillation techniques for measuring beta and gamma rays. No gamma ray of ~3 Mev is found; however, a gamma ray of 440 ± 5 kev occurs in 36 ± 4% of the beta decays. For both transitions, to the ground state as well as to the 440-kev level of Na^{23}, log ft ≈5.2. Upper limits for the intensity of higher energy gamma rays show that log ft ≥5.0 for possible transitions to other levels in Na^{23}. (auth)

6042

RADIATIONS FROM P^{30}, Cl^{34}, AND K^{38}. David Green and J. Reginald Richardson (Univ. of California, Los Angeles). Phys. Rev. 101, 776-8(1956) Jan. 15.

Results are reported on the measurement of the radiations from the 2.55-min activity in P^{30}, the 32.40 ± 0.04 min activity in Cl^{34} and the 7.7-min activity in K^{38} by means of a large double-lens spectrometer and a NaI scintillation spectrometer. P^{30} has a simple positron spectrum with end point at 3.24 ± 0.04 Mev and no gamma rays or conversion electrons. Cl^{34} has a complex positron spectrum with end points at 4.50 ± 0.03 Mev 2.48 ± 0.07 Mev, and 1.33 ± 0.10 Mev. K^{38} has a simple positron spectrum with end point at 2.68 ± 0.04 Mev and no conversion electrons. These results indicate an ft value for the ground (T = 1) state of Cl^{34} of 3160 ± 120 sec, and indicate that the ground states of P^{30} and K^{38} are probably the T = 0 states. (auth)

6043

DECAY OF Co^{61} AND Cu^{61}. R. H. Nussbaum, A. H. Wapstra, W. A. Bruil, M. J. Sterk, G. J. Nijgh, and N. Frobben (Instituut voor Kernphysisch Onderzoek, Amsterdam, Holland). Phys. Rev. 101, 905-6(1956) Jan. 15.

Coincidence β- and γ-scintillation spectrometers were used to study the decay of 1.66-hr Co^{61} and 3.33-hr Cu^{61}. The proposed decay schemes are shown. (B.J.H.)

6044

EVIDENCE FOR THE 258-KEV GAMMA RAY OF Sn^{113}. Gerald Gardner and John I. Hopkins (Vanderbilt Univ., Nashville, Tenn.). Phys. Rev. 101, 999-1000(1956) Feb. 1.

Measurements have shown that there appears to be a 258-kev gamma ray of Sn^{113} and that its intensity relative to that of the 393-kev gamma ray is 12% ± 2%. The half life for each gamma ray was measured to be approximately 130 days. (auth)

6045

INVESTIGATIONS OF I^{128}. N. Benczer, B. Farrelly, L. Koerts, and C. S. Wu (Columbia Univ., New York). Phys. Rev. 101, 1027-30(1956) Feb. 1.

The β^-, γ and electron capture processes of I^{128} were investigated with the solenoidal magnetic spectrometer, a single-channel scintillation spectrometer, a multiple-channel selective coincidence scintillation spectrometer, and a proportional counter spectrometer. Three β^- groups with energies 2.120, 1.665, and 1.125 Mev and relative abundance 76.0 : 15.5 : 2.0, and four γ radiations with energies 0.455, 0.540, 0.750, and 0.990 Mev and relative intensities 100 : 9.7 : 1.7 : 1.8 were found. The electron capture branch was determined to be 6.4% of the total disintegration. The ratio of electron capture to the ground to that to the first excited state of Te^{128} is 19:1. Spin and parity were assigned to the ground and excited states of the daughter nuclei Te^{128} and Xe^{128}, and a decay scheme was proposed for I^{128}. (auth)

6046

SEARCH FOR DOUBLE BETA DECAY IN Ca^{48} AND Zr^{96}. M. Awschalom (Univ. of Rochester, N.Y.). Phys. Rev. 101, 1041(1956) Feb. 1.

A new search for double β decay in Ca^{48} and Zr^{96}, using two scintillation detectors in a 4π solid angle geometry, was performed for underground, in order to reduce the background counting rates to small values in the spectral regions of interest. The results of this experiment showed no evidence for double β decay in either Ca^{48} or Zr^{96}. Lower limits for the half lives of these isotopes were estimated as follows: Ca^{48}, $T_{1/2} > 2 \times 10^{18}$ yr; Zr^{96}, $T_{1/2} > 0.5 \times 10^{18}$ yr. (auth)

6047

RADIATIONS FROM THE ACTIVE ISOTOPES OF YTTERBIUM. J. M. Cork, M. K. Brice, D. W. Martin, L. C. Schmid, and R. G. Helmer (Univ. of Michigan, Ann Arbor). Phys. Rev. 101, 1042-6(1956) Feb. 1.

By using Yb of high purity (99.8%) irradiated in the maximum flux of the Argonne pile and studied by scintillation and magnetic photographic spectrometers, a reevaluation of the energies of the radiations has been made. Several previously unreported gamma rays are found and nuclear level schemes for Tm^{169}, Lu^{175}, and Lu^{177} are proposed. Several of the levels appear to be rotational states in the unified nuclear model. Yb^{169} decays with a half life of 30.6 days by K capture, followed by eleven gamma rays in Tm^{169}. Rotational levels lie at 8.4, 118.3, and 139.1 kev. The gamma energies are 8.4, 20.6, 63.2, 93.6, 109.9, 118.3, 130.7, 177.7, 198.6, 261.0, and 308.3 kev. Yb^{175} decays with a half life of 4.2 days by β emission (471 kev max) followed by five gamma rays in Lu^{175}. Rotational levels exist at 114.1, and 251.9 kev. The gamma energies are 114.1, 137.8, 145.0, 282.9, and 397.0 kev. Yb^{177} decays with a half life of 1.88 hour by β emission followed by gamma transitions in Lu^{177}. In addition to any lower energy gamma rays, two high-energy transitions are found at 1.080 and 1.228 Mev. The latter is a cross over for the 1.080- and 0.148-Mev gammas which are in coincidence. The expected well-known daughter product Lu^{177}, if present at all, is too weak to be observed by the magnetic spectrometers. (auth)

6048

DECAY CHAIN Ca^{49}–Sc^{49}–Ti^{49}. G. D. O'Kelley, N. H. Lazar, and E. Eichler (Oak Ridge National Lab., Tenn.). Phys. Rev. 101, 1059-63(1956) Feb. 1.

The decays of Ca^{49} and its daughter have been studied by β- and γ-ray scintillation spectroscopy. Ca^{49} was observed to decay with a half life of 8.75 ± 0.20 minutes, exciting γ-ray transitions in Sc^{49} of 3.10 ± 0.03, 4.05 ± 0.05, and 4.68 ± 0.05 Mev energy and relative intensities of 1.0, 0.11 ± .02, and 0.0038 ± 0.0010. Two β-ray groups were resolved from the Ca^{49} spectrum of energy 1.95 ± 0.05 and 0.89 ± 0.15 Mev. In agreement with previous work, Sc^{49} was found to be a pure β emitter. The β-ray energy of Sc^{49} was measured as 2.05 ± 0.05 Mev, and the half life was found to be 57.2 ± 0.7 minutes. Spin assignments are proposed on the basis of the single-particle model. (auth)

6049

ALPHA HALF-LIFE OF Pu^{244}. Herbert Diamond and Raymond F. Barnes (Argonne National Lab., Lemont, Ill.). Phys. Rev. 101, 1064-6(1956) Feb. 1.

The half life of Pu^{244} was found to be $(7.6 \pm 2) \times 10^7$ years by measuring the activity of its Np^{240} decay product. The possibility of detecting Pu^{244} in nature with current techniques and the role of Pu^{244} and its daughters as an early source of terrestrial heat are discussed. (auth)

6050

SMALL-ORDER EFFECTS IN BETA SPECTRA. A. V. Pohm, R. C. Waddell, and E. N. Jensen (Iowa State Coll., Ames). Phys. Rev. 101, 1315-21(1956) Feb. 15.

An intermediate-image spectrometer and a thin-lens spectrometer was used to examine carefully the beta spectra of P^{32}, K^{42}, and As^{76}. The P^{32} beta spectrum was examined for a Fierz-type deviation, and within the experimental error none was found. The value of the parameter r, describing the magnitude of the Fierz deviation as defined by Davidson and Peaslee, was found to be 0.00 ± 0.03. The first forbidden transitions with $\Delta I = 0$, "yes" of K^{42} and As^{76} were examined for deviations from a linear Kurie plot. Within experimental error no deviations were found. From the shape factors calculated by Mahmoud and Konopinski on the basis of an STP combination, one would expect deviations for these first-forbidden transitions if the best previous estimate of certain parameters are correct. A deviation of the K^{42} Kurie plot below 500 kev was attributed to an additional beta group. (auth)

6051

DISINTEGRATION OF Sc^{47}. William E. Graves and S. K. Suri (Indiana Univ., Bloomington). Phys. Rev. 101, 1368-70 (1956) Feb. 15.

The disintegration of Sc^{47} has been investigated with the help of magnetic spectrometers, scintillation spectrometers, and coincidence counting. There are two beta-ray groups of end-point energies 0.600 ± 0.002 (40%) and 0.439 ± 0.002 (60%) Mev, and one gamma ray of 0.159 Mev. The gamma ray is in coincidence with the lower energy group. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

6052 AERE-Lib/Trans-491

ZEEMAN EFFECT OF ELECTRON AND VIBRATIONAL LINES IN SINGLE CRYSTALS OF PRASEODYMIUM AND NEODYMIUM SALTS. J. Brochard and K. H. Hellwege. Translated by R. J. Richardson from Z. Physik 135, 620-38 (1953). 17p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-1448.

SHIELDING

6053 NRL-4695

Naval Research Lab., Washington, D. C.

PSEUDORANDOM NUMBERS AND COLLISION PARAMETERS FOR MONTE CARLO SHIELDING CALCULATIONS. R. B. Theus and L. A. Beach. Jan. 12, 1956. 9p.

Since the Monte Carlo method involves random sampling under probability distribution functions which describe the phenomenon being studied, a modified "midsquare" method of generating pseudorandom numbers for Monte Carlo calculations has been developed. The numbers have been generated and analyzed for uniformity of population by the NAREC. Distribution functions used in radiation shielding problems were obtained from these numbers and they compare favorably with the theoretical expectations. (auth)

6054 NRL-4701

Naval Research Lab., Washington, D. C.

GAMMA-RAY ALBEDO FROM IRON. R. B. Theus and L. A. Beach. Jan. 20, 1956. 8p.

A major problem in designing the radiation shield for a power reactor results from the radioactivity induced in the primary coolant. Since the operating personnel must be protected from the radiation emanating from this circulating coolant as well as from the reactor proper, Monte Carlo methods have been used to calculate the gamma-ray albedo for the 6.13-Mev photons incident on iron. The spectral and directional distributions of the emerging radiation are given as a function of the angle of incidence. (auth)

SPECTROSCOPY

6055 K-1290

Oak Ridge Gaseous Diffusion Plant, Tenn.

THE SPECTRUM OF MONOMERIC HYDROGEN FLUORIDE: MOLECULAR CONSTANTS, LINE SHAPES, INTENSITIES AND BREADTHS (thesis). George A. Kuipers. June 21, 1956. 154p. Contract W-7405-eng-26. $24.30 (ph OTS); $7.50(mf OTS).

Submitted as a thesis to the Univ. of Tennessee.

The infrared vibration-rotation spectrum of HF has been re-examined out through J = 11 for the fundamental, and through J = 8 for the first overtone. The intensities and shapes of the lines in the fundamental band of HF have been studied at 117°C and pressures ranging from 200 to 3860 mm Hg. Slit corrections amounted to less than 3% in the absorption coefficient at 3860 mm Hg for the lines R(5) to P(7) and went as high as 25% on even the strong lines at 700 mm Hg. The lines were found to be symmetrical about the line center. A shift in the line centers of the order of tenths of a wave number at 3860 mm Hg was observed. The line breadths vary with J from 0.5 to less than 0.2 cm^{-1}/atm. A study of the line intensities gives M_1, the derivative of the dipole moment with respect to the internuclear distance, $r-r_e$, to be: $M_1 = 1.6 \times 10^{-10}$ esu, with the dipole moment increasing with increase in r. Interaction of vibrational and rotational energy results in an observed increase in the line intensities of the P-branch and a decrease in the R-branch. In the wings of the lines, where no slit corrections are required, the absorption coefficient was found to be quadratic in the pressure and always appreciably higher than calculated for a Lorentz line of the same height and breadth. A study of the R(2) line at a number of pressures revealed that absorption coefficient at the line center decreased 11% with increase in pressure from 700 to 3860 mm Hg. A small absorption band was observed adjacent to the band center, on the high wave number side. (auth)

6056

INFRARED ABSORPTION STUDIES OF AQUEOUS COMPLEX IONS. II. CYANIDE COMPLEXES OF Cu(I) IN AQUEOUS SOLUTION. Robert A. Penneman and Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 24, 293-6(1956) Feb.

The infrared absorption spectra of three complex ions, $Cu(CN)_2^-$, $Cu(CN)_3^{2-}$, and $Cu(CN)_4^{3-}$ were observed in the $CuCN-KCN-H_2O$ system. Thermodynamic values and dissociation constants were calculated. (C.W.H.)

6057

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS. X. p-FLUOROCHLORO-, p-FLUOROBROMO-, AND p-FLUOROIODOBENZENE. N. A. Narasimham, M. Z. El-Sabban, and J. Rud Nielsen (Univ. of Oklahoma, Norman). J. Chem. Phys. 24, 420-32(1956) Feb.

The infrared absorption spectra of liquid p-fluorochloro-, p-fluorobromo-, and p-fluoroiodobenzene, and the stronger bands of the first two compounds in the gaseous state, have been obtained in the region 2 to 38μ with NaCl and CsBr prisms. The Raman spectra of the compounds in the liquid state have been photographed with a 3-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A, and depolarization ratios have been measured for the stronger Raman bands of p-fluorochloro- and p-fluorobromobenzene. Complete assignments of the fundamental vibrational frequencies have been made, and the spectra are interpreted in detail. (auth)

6058

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS. XI. o-FLUOROCHLOROBENZENE. N. A. Narasimham and

J. Rud Nielsen (Univ. of Oklahoma, Norman). J. Chem. Phys. 24, 433-8(1956) Feb.

The infrared absorption spectra of gaseous and liquid o-fluorochlorobenzene have been obtained in the region 2 to 38μ with NaCl and CsBr prisms. The Raman spectrum of the liquid has been photographed with a 3-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A. A complete assignment of the fundamental vibrational frequencies is given, and the spectra are interpreted in detail. (auth)

6059

MEASUREMENT OF THE RATE OF AN ELECTRON EXCHANGE REACTION BY NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY. C. R. Bruce, R. E. Norberg, and S. I. Weissman (Washington Univ., St. Louis, Mo.). J. Chem. Phys. 24, 473-5(1956) Feb.

The electron exchange reaction between N, N, N', N', tetramethyl-p-phenylenediamine (TMPB) and Wurster's Blue has been studied by nuclear magnetic resonance spectroscopy. This method should be applicable to electron exchange reactions for which $k > 3 \times 10^3$ l/mol/sec. (C.W.H.)

6060

THE ABSORPTION SPECTRA OF NATURAL AND IRRADIATED DIAMONDS. C. D. Clark, R. W. Ditchburn, and H. B. Dyer (Univ. of Reading). Proc. Roy. Soc. (London) A234, 363-81(1956) Feb. 21.

The absorption spectra of fifty-two natural diamonds have been measured at 80 and 290°K. Type I diamonds are shown to have two kinds of absorption centers which are not detected in type II diamonds. Differences in the infra-red absorption spectra between type IIa and type IIb diamonds are reported. The classification of diamonds is discussed. The absorption produced by irradiating diamonds with electrons, neutrons and γ-rays is described. The general nature of the changes produced by the different forms of radiation is the same, but significant differences in the breadths and wavelengths of the induced absorption lines have been observed. Electron-irradiated type IIa diamonds show absorption lines not observed in irradiated type I diamonds. There is a similarity between the sets of natural absorption lines in type I diamonds and those produced by irradiation. A model relating the induced absorption to interstitial carbon atoms, vacant atomic sites and regions of amorphous or graphitic carbon is proposed. (auth)

6061

ON THE DEPENDENCE OF THE X-RAY SPECTRA ON THE CHEMICAL BOND. Heribert Herglotz and Ernst Deimel. Acta Phys. Austriaca 10, 127-41(1956) Jan. (In German).

By utilization of mathematical relationships known from precise lattice constant measurements in metallurgy, the dependence of the $K\beta_1$ line on binding for various cobalt bonds is measured, and the precision from simple reflection cameras exceeds that obtained with classical spectrographs. (tr-auth)

THEORETICAL PHYSICS

6062 UCRL-4699

California. Univ., Livermore. Radiation Lab.

ON THE TREATMENT OF 4f ELECTRONS BY A MODIFIED FERMI-THOMAS MODEL (thesis). Benjamin Sussholz. Feb. 22, 1956. 40p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

The modified model appears to warrant some merit in view of the accuracy in predicting the distribution of 4f electrons over the range of the rare earths. Regarding its application toward compressibility calculations, the agreement between the pressure values obtained by the virial theorem and by $-dE/dv$ indicates an internal consistency. In the region of high compressions, pressure values are quite sensitive to the nature of the boundary conditions assumed for the 4f radial wave functions. In general, it appears that no significant deviations from compressibility properties based on the straightforward Fermi-Thomas theory have been established by the present separate treatment of the 4f electrons. (auth)

6063 AERE-Lib/Trans-648

THE STABILITY OF SHOCK WAVES. INVESTIGATION OF THE PROBLEM OF THE STABILITY OF SHOCK WAVES IN ARBITRARY MEDIA. S. P. D'yakov. Translated by V. Beak from Zhur. Eksptl'. Teoret. Fiz. 27, 288-95(1954). 13p.

Conditions of instability of shock waves were found in a study of the stability of shock waves in an arbitrary medium. The phenomenon of the spontaneous emission of sound by shock waves was revealed and the conditions for its possible existence were determined. (F.S.)

6064 AERE-Lib/Trans-655

ON THE THEORY OF THE WIDTH OF ATOMIC SPECTRAL LINES. I. I. Sobel'man. Translated by V. Beak from Uspekhi Fiz. Nauk 54, 551-86(1954). 38p.

New results and advances in the theory of the widening of spectral lines caused by the interaction of the radiating atom with the particles surrounding it, i. e. other atoms, molecules, ions, and electrons are discussed. (F.S.)

6065

PRINCIPAL AXIS TRANSFORMATION FOR A FREE NUCLEON COUPLED TO AN UNCHARGED SCALAR MESON FIELD. Kirk McVoy (Cornell Univ., Ithaca, N. Y.) and Helmut Steinwedel (CERN, Copenhagen, Denmark). Nuclear Phys. 1, No. 3, 164-79(1956).

The Hamiltonian for a free nucleon coupled to an uncharged scalar meson field is transformed to normal modes after dropping all terms higher than quadratic in the (field and particle) variables. The resulting normal modes represent scattering states and the "runaway solutions" well-known from the corresponding electromagnetic case, whereas no excited states of the nucleon occur. (auth)

6066

THEORY OF THE IONIZATION CASCADE. J. E. Moyal (Univ. of Sydney, Australia). Nuclear Phys. 1, No. 3, 180-95(1956).

The statistical problem connected with the ionization cascade, that is, the cascade of knock-on electrons produced by a fast primary particle passing through matter, is to obtain the distribution of quantities of interest connected with the cascade, such as the number of electrons in a given energy range, given the ionization cross sections. An exact solution of this problem is given in very general terms, which will yield all such distributions. With the help of suitable approximations, the distributions of the number of fast knock-on electrons of energy $\geq$ given value W, and the total number of ion-pairs produced by the primary particle, are obtained in a form suitable for numerical computation. (auth)

6067

THEORY OF THE NEGATIVE PROTON. J. McConnell (St. Patrick's Coll., Maynolth, Ireland). Nuclear Phys. 1, No. 3, 202-28(1956).

A method of calculating approximately cross-sections for negative proton production according to the ps-pv and ps-ps meson theories is given. The loss of negative protons by annihilation and by meson production is discussed. An application of the results shows that is difficult to detect the negative proton in cosmic radiation. (auth)

6068

ON THE CHARACTERISTIC PROPERTIES OF THE NUCLEAR LINEAR OPERATORS. A. S. Markus. Doklady Akad. Nauk S.S.S.R. 105, 1144-6(1955) Dec. 21. (In Russian).

6069
QUANTUM CALCULATION OF COULOMB EXCITATION. II. QUADRUPOLE EXCITATION: NUMERICAL RESULTS. L. C. Biedenharn, M. Goldstein, J. L. McHale, and R. M. Thaler (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 101, 662-8(1956) Jan. 15.

The formal methods for the quantum-mechanical treatment of Coulomb excitation discussed earlier are here applied to obtain numerical results for the electric quadrupole case. Tables of the excitation function and the directional correlation parameters are presented and discussed for a wide range of their arguments. (auth)

6070
INTEGRATED PHOTONUCLEAR CROSS SECTION. J. S. Levinger (Louisiana State Univ., Baton Rouge). Phys. Rev. 101, 733(1956) Jan. 15.

A step in the Levinger-Bethe calculation of the nuclear exchange force contribution to the summed dipole oscillator strength is examined. The reduction of a triple sum to the double sum used by Levinger and Bethe can be justified if complete symmetry between neutrons and protons is assumed. (auth)

6071
APPLICATION OF THE BACHER AND GOUDSMIT METHOD TO NUCLEAR SPECTRA. S. Meshkov (Univ. of Delaware, Newark) and C. W. Ufford (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 101, 734-9(1956) Jan. 15.

A method for the calculation of nuclear l^n matrix elements in terms of those of l^{n-1} is developed, assuming two-particle interactions. An example is the calculation of p^3 matrix elements as linear combinations of p^2 matrix elements. The coefficients in these linear combinations are tabulated. Application is made by calculating $_3Li^7$ energies from $_3Li^6$ energy data. A comparison of the calculated energies of $_3Li^7$ with experiment leads to some restrictions on the nuclear potential. To perform the calculation it is necessary to fit the $_3Li^6$ data; the results of the fit are presented. The existence of a $J = 5/2^-$ energy level in $_3Li^7$ at or near 6.53 Mev is also discussed. (auth)

6072
PHASE-SPACE INTEGRALS FOR MULTIPARTICLE SYSTEMS. M. M. Block (Duke Univ., Durham, N. C.). Phys. Rev. 101, 796-9(1956) Jan. 15.

The total phase-space integrals, occurring in the Fermi statistical theory of meson production for 2-, 3-, 4-, and 5-body final states are reduced to forms suitable for numerical evaluation by hand computation. In addition, the momentum spectrum of any one particle, as derived from the statistical factor, is evaluated. For the 3- and 4-body systems, the Q distribution for any two of the particles (effective mass minus the rest masses of the 2-particle subsystem) is derived. Numerical results are presented for nucleon-nucleon collisions at 0.8-, 1.5-, and 2.7-Bev bombarding kinetic energies. (auth)

6073
EFFECTS OF SHORT-RANGE CORRELATIONS BETWEEN TWO PROTONS IN ELASTIC SCATTERING OF HIGH-ENERGY ELECTRONS BY HEAVY NUCLEI. B. W. Downs (Stanford Univ., Calif.). Phys. Rev. 101, 820-5(1956) Jan. 15.

An expression is obtained for the leading term in the two-proton contribution to the scattering cross section, with a two-proton charge density which is a Yukawa function of the separation between two protons. The cross section for scattering from more complicated charge distributions can be generated from this basic result by differentiation with respect to the Yukawa range parameter. The two-proton cross section is evaluated for a charge density in which short-range correlations in position between two protons appear. Results are given for the scattering of 600-Mev electrons by heavy nuclei. (auth)

6074
VACUUM POLARIZATION IN A STRONG COULOMB FIELD. Eyvind H. Wichmann and Norman M. Kroll (Columbia Univ., New York). Phys. Rev. 101, 843-59(1956) Jan. 15. (cf. NSA 8-7188).

A study is carried out of the vacuum polarization in a strong Coulomb field. Radiative corrections are neglected. A perturbation calculation is avoided by making use of the explicit solutions of the Dirac equation in a Coulomb field. The Laplace transform of the polarization charge density times r^2 is found and used as a basis for further study. It is proved to be an analytic function of the strength of the inducing charge. It is verified that the first-order term in a power series expansion in the strength of the inducing charge just corresponds to the Uehling potential. The third-order term is studied in some detail. The leading term in the polarization potential close to the inducing charge and the space integral of the induced potential divided by r are found to all orders in the strength of the inducing charge. Ambiguities are handled by a method corresponding to regularization. Some experimental applications are considered. The corrections to the Uehling term in these cases are found to be small. (auth)

6075
RADIATIVE CORRECTIONS TO DECAY PROCESSES. R. E. Behrends, R. J. Finkelstein, and A. Sirlin (Univ. of California, Los Angeles). Phys. Rev. 101, 866-73(1956) Jan. 15.

Radiative corrections associated with the electromagnetic field have been determined for the decay of a fermion of arbitrary mass into a lighter one with the emission of a single boson or of two other fermions; no special assumptions have been made about the nature of the interaction responsible for the instability. The particular example of the muon-electron decay has been worked through in detail. Sufficiently accurate experimental determination of the muon spectrum would permit the observation of a Lamb term without vacuum polarization. Modified formulas for the Michel parameter ρ are given. (auth)

6076
STRANGE PARTICLES AND THE CONSERVATION OF ISOTOPIC SPIN. K. M. Case, Robert Karplus, and C. N. Yang (Univ. of California, Berkeley). Phys. Rev. 101, 874-6(1956) Jan. 15.

The question is considered as to whether complete rotational symmetry in isotopic spin space is necessary. In particular, the classification of elementary particles on the basis of the representations of a finite group is attempted. It is found that for the particles whose reactions are known, the law of conservation of charge results in a scheme essentially equivalent with ones previously proposed. However, some additional freedom is found which would accommodate particles with rather unusual properties if such are ever observed. (auth)

6077
RELATIONS BETWEEN BOUND-STATE PROBLEMS AND SCATTERING THEORY. Alfred Reifman and Bryce S. DeWitt (Univ. of California, Berkeley) and Roger G. Newton (Indiana Univ., Bloomington). Phys. Rev. 101, 877-9(1956) Jan. 15.

An operator that takes an "unperturbed" two-particle eigenvector belonging to the discrete spectrum of a potential well of finite width into that including a short-range interaction is examined in the limit as the well width tends to infinity. It is found to approach the K operator, which satisfies the integral equation using the principal value of the kernel. The result sheds light on Brueckner's equations, which can now be formulated entirely in bound-state language. The connection between forward scattering amplitude and energy shift used in a recent paper on the π-mesonic atom is also commented on. (auth)

6078
OPTICAL MODEL POTENTIAL FOR PION-NUCLEUS SCATTERING. R. M. Frank, J. L. Gammel, and K. M. Watson (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 101, 891-901(1956) Jan. 15.

The assumption that two-body forces are not appreciably modified within nuclei offers the possibility of calculating the optical-model potential from two-body scattering phenomena. For instance, the dispersion relations recently proposed by Goldberger permit one to make a calculation of the pion-nucleus well depth directly from observed pion-nucleon scattering cross sections. The results predict a rather striking variation with energy for this potential and appear to be in fair agreement with the available experimental data. The physical basis for the potential is investigated. Numerical calculations using meson theory (in the form proposed by Chew) are in disagreement with the results from the dispersion relations (as well as the experimental values). This involves solving an equation closely related to that used by Brueckner et al. in their study of nuclear saturation. The relations of the potential to various nuclear properties are discussed—for instance, it is shown in detail that the resolution of the nuclear radius is limited to the range of the two-body interaction. (auth)

6079
RADIATIVE AND NONRADIATIVE BOSON DECAY INTO LEPTONS. Sidney A. Bludman and Malvin A. Ruderman (Univ. of California, Berkeley). Phys. Rev. 101, 910-11(1956) Jan. 15.

Equations are given for the probability of the radiative decay of bosons into leptons. (B.J.H.)

6080
STOPPING POWER OF L-ELECTRONS. M. C. Walske (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 101, 940-4 (1956) Feb. 1.

The Bethe theory of the energy loss of fast charged particles is extended to treat explicitly the stopping contribution of L-shell electrons. A summary of the effect of binding corrections on stopping power is given. (auth)

6081
SELF-ENERGY OF DIRAC PARTICLES. Kerson Huang (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 101, 1173-82(1956) Feb. 1.

Weisskopf's analysis of the electron self-energy in 1939 showed that the part of the self-energy that is due to the spin of the particle is negative. An extension of this analysis with the addition of a Pauli term to the Hamiltonian shows that the additional self-energy that arises is also negative and only adds to the original spin self-energy. The physical significance of this negative spin energy is discussed in detail. With the choice of an appropriate cutoff, the total self-energy of a Dirac particle with a Pauli anomalous magnetic moment can be made negative. A possible explanation of the neutron-proton mass difference in terms of their difference in electromagnetic self-energy, as first pointed by Feynman and Speisman, is considered in the light of such an analysis of the self-energy. (auth)

6082
RENORMALIZATION CONSTANTS. Yoichiro Nambu (Institute for Nuclear Studies, Chicago). Phys. Rev. 101, 1183-6 (1956) Feb. 1.

From a study of the formulas which relate Dyson's renormalization constants to the spectral functions introduced earlier, it is shown that the charge (coupling) renormalization constant Z_1 must be zero. The symmetrical pseudoscalar meson theory is taken as an example, but the result is not necessarily restricted to this case only. (auth)

6083
NUCLEON ANOMALOUS MOMENTS VIA PION-PION ATTRACTION. W. G. Holladay (Univ. of Wisconsin, Madison). Phys. Rev. 101, 1198-1201(1956) Feb. 1.

The importance of a pion-pion attraction for calculating nucleon anomalous moments is emphasized. It is found that resonably strong pion-pion attraction is capable of giving large enough moments, even if the mirror condition of Sachs is imposed. It is pointed out that many effects, such as core recoil, interaction currents, and excited cores offer no relief in calculating large enough moments. (auth)

6084
NUCLEON STRUCTURE AND THE n-p MASS DIFFERENCE. W. G. Holladay (Univ. of Wisconsin, Madison). Phys. Rev. 101, 1202-5(1956) Feb. 1.

The possibility of understanding the n−p mass difference by means of electromagnetic interactions among the particles of a structured nucleon is pointed out. The success of this approach depends on the same general features that seem to be necessary in understanding the nucleon moments, namely, the enhancement of the annihilation of a π^+, π^- pair. Thus, further confirmation is provided for the hypothesis of a pion-pion attraction. Information on the spatial extent of the pion cloud is obtained, namely that $\rho \approx 2.4$ nucleon Compton wavelengths, where ρ^{-3} is related to the average of the inverse cube of the distance between the pions and the core. (auth)

6085
ISOTOPIC SPIN OF ANTIPARTICLES. Joseph V. Lepore (Univ. of California, Berkeley). Phys. Rev. 101, 1206-7 (1956) Feb. 1.

The eigenvalues of τ_3, the isotopic spin operator describing protons and neutrons, are usually taken as +1, −1 respectively. At first sight there appears to be some arbitrariness in the corresponding assignments for antiprotons and antineutrons, since either +1, −1 or −1, +1 seem to be logical possibilities; however, it is shown that in order to construct a theory involving nucleons, mesons, and the electromagnetic field which is invariant under electric charge conjugation only the first possibility is allowed. (auth)

6086
REFINEMENT OF THE BRILLOUIN-WIGNER PERTURBATION METHOD. Paul Goldhammer and Eugene Feenberg (Washington Univ., St. Louis, Mo.). Phys. Rev. 101, 1233-4 (1956) Feb. 15.

New variational parameters are introduced into the wave function employed in the Brillouin-Wigner perturbation method, and determined to minimize the total energy. The original and modified procedures are illustrated by a numerical example. (auth)

6087
PERTURBATION PROCEDURE FOR BOUND STATES OF NUCLEI. Mark Bolsterli and Eugene Feenberg (Washington Univ., St. Louis, Mo.). Phys. Rev. 101, 1349-57(1956) Feb. 15.

The model of nucleons moving in a fixed harmonic oscillator well provides a convenient starting point for calculations on the structure of light nuclei. One complication, the nondiagonal energy operator associated with the motion of the center of mass, can be eliminated simply by adding the harmonic potential operator of the center-of-mass motion to the correct Hamiltonian operator of the system. Following the construction of the correct zeroth-order linear combinations (in case of degeneracy) and the evaluation of the first-order energy matrix, the further development of the theory, in the direction of an exhaustive investigation of the consequences of assumed interaction operators, requires the evaluation of second- and higher order contributions to the energy. A simple, accurate, and powerful procedure for evaluating the second-order energy and other second-order quantities in closed form is described and explicit formulas

are given for the application to the ground states of the deuteron, the triton, and the alpha particle. Numerical results for the deuteron, where a comparison with exact calculations is possible, are surprisingly good. The extension of these calculations to the first p-shell and beyond with the aid of the technique of fractional parentage coefficients appears feasible. (auth)

6088

DEUTERON-DEUTERON REACTION AT HIGH-ENERGY. Yoshihiko Nishida (Saga Univ., Japan). Progr. Theoret. Phys. (Japan) 14, 495-6(1955) Nov.

The reaction of $d + d \rightarrow H^3 + p$ is used to analyze the contribution of the direct, indirect, and interference processes to the angular distribution in pure stripping. Expressions are derived and the angular distribution plotted. (D.E.B.)

6089

THEORIES OF NUCLEAR MOMENTS. R. J. Blin-Stoyle (Clarendon Lab., Oxford, England). Revs. Mod. Phys. 28, 75-101(1956) Jan.

Available data on nuclear moments are discussed in terms of current nuclear theories. It is shown that no single theory accounts for all the observed nuclear moments, however, each theory has applications which add to the overall description. Tables of electromagnetic moments of odd proton and odd neutron nuclei are included. (D.E.B.)

6090

DESCRIPTION OF THE ELECTROMAGNETIC FIELD BY MEANS OF MATRICES. G. A. Zaitsev. Soviet Phys. JETP 1, 411-14(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 524-9(1955) May. (In Russian).

The characteristics of matrix-tensors are described. The equations of the electromagnetic field are given in matrix form. (auth)

6091

SOME OBSERVATIONS ON POSSIBLE FORMULATIONS OF THE THEORY OF EXTENDED PARTICLES. V. S. Barashenkov. Soviet Phys. JETP 1, 467-70(1955) Nov. (In English). Zhur. Eksptl.' i Teoret Phys. 28, 579-83(1955) May. (In Russian).

Some of the features of possible formulations of a theory of non-localized fields are considered. In particular, it is shown that if the operators of the non-localized fields are considered to be non-diagonal matrices in coordinate space, then non-interacting non-localized fields cannot be equivalent to an aggregate of fields of local type. Finally some considerations are presented concerning the comparison of results of a theory of extended particles with experiment. (auth)

6092

THE REPRESENTATION OF GREEN'S FUNCTION IN QUANTUM ELECTRODYNAMICS IN THE FORM OF CONTINUAL INTEGRALS. I. M. Khalatnikov (Inst. of Physical Problems). Soviet Phys. JETP 1, 568-71(1955) Nov. (In English). Zhur. Eksptl.' i Teoret. Fiz. 28, 633-5(1955) May. (In Russian).

Refer also to abstract 5881.

TRITIUM AND TRITIUM COMPOUNDS

Refer to abstract 5887.

URANIUM AND URANIUM COMPOUNDS

6093 UCRL-3337

California. Univ., Berkeley. Radiation Lab. ABSOLUTE NEUTRON SPECTRA FROM 190-MEV PROTON BOMBARDMENT OF URANIUM. Edward E. Gross. Mar. 8, 1956. 10p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

The differential cross section for the production of neutrons from 190-Mev proton bombardment of U has been measured at 135° and 45° to the beam direction in the neutron energy interval 0.5 to 12 Mev. The neutrons were detected by the observation of proton recoils in nuclear emulsions. The internal cyclotron beam was monitored by comparing the activity of polyethylene foils placed over the target to the activity of polyethylene foils exposed to the external cyclotron beam. The differential cross section at 135° appears identical with the differential cross section at 45°. The observed spectral shape is in good agreement with evaporation theory as amended by LeCouteur. Assuming spherical symmetry in the laboratory system, we have 17.8 ± 3.6 barns as the total cross section for the production of neutrons in the energy interval 0 to 12 Mev by 190-Mev proton bombardment of U. It is concluded that 9.4 ± 1.9 neutrons are evaporated per inelastic collision of 190-Mev protons with U, and that the average excitation energy delivered to the struck nucleus is 88 ± 18 Mev. (auth)

6094

MAGNETOCHEMISTRY OF THE HEAVIEST ELEMENTS. PART IX. THE SYSTEM UO_2-ThO_2-O. J. K. Dawson and L. E. J. Roberts (Atomic Energy Establishment, Harwell, Berks, England). J. Chem. Soc., 78-80(1956) Jan.

The magnetic susceptibility per U atom of partially oxidized samples of UO_2-ThO_2 solid solutions has been measured at three different UO_2 concentrations. In each case the susceptibility decreased linearly as the average valency of the U increased from 4 to 5, more rapidly than in the oxidation of pure UO_2 and at a rate that would have led to zero susceptibility before the U reached a valency of 6. A possible explanation is that U^{4+} is replaced by U^{5+} in the initial stages of oxidation of these mixed crystals. (auth)

6095

X-RAY DIFFRACTION STUDY OF THE NITRIDES OF URANIUM. D. A. Vaughan (Battelle Memorial Inst., Columbus, Ohio). J. Metals 8, 78-9(1956) Feb.

Results of x-ray diffraction analysis of the nitride phases present when U is reacted with N_2 at temperatures between 500 and 915°C indicate the existence of a new nitride phase having a nitrogen composition between UN_2 and UN. A hexagonal-close-packed structure (La_2O_3-type) and a molecular composition of U_2N_3 are suggested. (C.W.H.)